2008-2013 OPERATION, MAINTENANCE AND MONITORING REPORT

LCP BRIDGE STREET SITE (OU-1)
Solvay, New York

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JULY 2014

TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY 1

1.0 INTRODUCTION 2

2.0 BACKGROUND AND SUMMARY OF REMEDIAL ACTIONS.....2

3.0 OM&M ACTIVITIES AND RESULTS 3
- 3.1 Site Inspections and Groundwater Extraction System Operations.....4
- 3.2 Site Surface Water.....5
- 3.3 Wetland Sediment 5
- 3.4 Wetland Restoration Monitoring.....6
- 3.5 Site Biota 6

4.0 CONCLUSIONS 6
- 4.1 Surface Water 6
- 4.2 Sediments 7
- 4.3 Biota 7
- 4.4 Wetland Restoration 7

5.0 RECOMMENDATIONS.....7

6.0 REFERENCES 8

LIST OF TABLES

Table 1 LCP OM&M Sampling Summary

Table 2 LCP Recommended OM&M Sampling and Monitoring Changes

TABLE OF CONTENTS
(CONTINUED)

LIST OF FIGURES

Figure 1 LCP Site Plan
Figure 2 Additional Soil/Sediment Removals
Figure 3 Piezometer/Monitoring Well Locations
Figure 4 2008 - 2013 Surface Water/Sediment Sampling Locations
Figure 5a Average Dissolved Mercury in Surface Water
Figure 5b Total Dissolved Mercury Trends in Surface Water 2009-2013
Figure 6a Average Total Mercury in Sediment
Figure 6b Total Mercury Trends in Sediment 2008-2013
Figure 7 Total Number of Plant Species Documented 2008-2013
Figure 8 Average Total Mercury in Biota
Figure 9 Wetland A and B Water Levels
Figure 10 Proposed Wetland A & C OM&M Monitoring and Sample Locations

LIST OF APPENDICES

APPENDIX A LCP OU-1 OM&M SURFACE WATER, SEDIMENT, AND BIOTA DATA
APPENDIX B WETLANDS MONITORING REPORT - YEAR 5 (2012)

ACRONYMS

ARARs	Applicable or Relevant and Appropriate Requirements
CWTP	Construction water treatment plant
FS	Feasibility Study
LEL	Lower effect limit
LCP	Linden Chemicals and Plastics
METRO	Metropolitan Wastewater Treatment Facility
µg/L	Micrograms per liter
mg/kg	Milligram per kilogram
ng/L	Nanogram per liter
NYSDEC	New York State Department of Environmental Conservation
OM&M	Operation Maintenance & Monitoring
OU-1	Operating Unit One
RAO	Remedial Action Objectives
RI	Remedial Investigation
ROD	Record of Decision
SEL	Sever Effects Limit

2008-2013 OPERATION, MAINTENANCE AND MONITORING REPORT

EXECUTIVE SUMMARY

The Linden Chemicals and Plastics (LCP) Bridge Street Superfund Subsite of the Onondaga Lake site is located in the Village of Solvay, Town of Geddes, Onondaga County, New York. Operation, maintenance, and monitoring (OM&M) activities began at the site in 2008 following completion of the remedial action in 2007. The remedial action had two goals: to reduce the levels of mercury at the site and to restore the LCP wetlands. One of the primary goals of the OM&M program is to document the success of the remedy and habitat restoration by routinely analyzing sediment, surface water, and biota samples, and collecting annual data on wetland vegetation establishment.

Overall, restoration of the LCP wetlands has been tremendously successful. Areas that were previously dominated by a monoculture of the invasive common reed with little habitat value are now diverse wetlands that support a mix of plant and animal species (including a nesting population of the State–listed, pied-billed grebe) and contain a wide variety of aquatic habitat. The improvement in habitat value of these areas is significant, and wildlife usage of the restored areas is extensive. For example, the number of native plant species recorded each year increased steadily from 77 species the first year after restoration (2008) to 155 species in 2012.

The results of the first six years of monitoring indicate that the LCP remedy has significantly reduced the pre-remediation levels of mercury in surface water, sediment, and biota, and therefore a reduction in the long-term wetland maintenance and monitoring activities is warranted. Monitoring of mercury in sediment will continue annually in Wetland A and the West Flume at the same locations as in the past. Annual sampling of sediment and surface water mercury concentrations should be initiated in 2014 at three locations in Wetland C (former Dredge Spoils Area). Restoration monitoring should continue at locations monitored in 2013 in portions of Wetland A where additional removals occurred and in Wetland C.

1.0 INTRODUCTION

The operation, maintenance and monitoring (OM&M) program being implemented at the Linden Chemicals and Plastics (LCP) Bridge Street Operable Unit (OU-1) site in Solvay, New York began in August 2008. This report is being submitted to the New York State Department of Environmental Conservation (NYSDEC) in accordance with Section 6.4 of the LCP OM&M Plan (Parsons 2009b).

This report summarizes OM&M activities since startup (2008 through 2013), presents monitoring trends, and provides recommendations for modifications to the site monitoring program. Since remedial activities are still occurring in the containment area, the recommendations focus on modifications to monitoring of the West Flume and the site wetlands. Specific site data are summarized in the following reports:

- 2009 Annual OM&M Report For The LCP Bridge Street Site (OU-1) (Parsons 2010)
- 2010 Annual OM&M Report For The LCP Bridge Street Site (OU-1) (Parsons 2013a)
- 2011 Annual OM&M Report For The LCP Bridge Street Site (OU-1) (Parsons 2013b)
- 2012 Annual OM&M Report For The LCP Bridge Street Site (OU-1) (Parsons 2013c)

2.0 BACKGROUND AND SUMMARY OF REMEDIAL ACTIONS

The LCP site is located approximately two miles west of Syracuse in the Village of Solvay, Town of Geddes, Onondaga County, New York. Figure 1 shows the site layout. Based on the results of the Remedial Investigation (RI) (NYSDEC 1999), Feasibility Study (FS) (Parsons ES 1999), and public comments, a Record of Decision (ROD) (NYSDEC 2000) was issued on September 29, 2000, which identified the selected remedy for the LCP site. On March 21, 2002, the Order on Consent (Index #D7-0001-00-12) for the LCP Bridge Site (NYSDEC 2002) was signed between NYSDEC and Honeywell. The Order on Consent identified mercury as the primary compound of concern at the LCP Site and stated that the presence of mercury at the site and in its proximity and discharge of mercury to the West Flume represented a release or threat of release to Onondaga Lake.

The ROD stipulated the following remedial action objectives (RAOs) for the LCP site:

- Eliminate, to the extent practicable, contaminant migration from the site to Onondaga Lake environs and environmental media (e.g., groundwater, surface waters, soil, air, and sediment)
- Restore, to the extent practicable, groundwater quality to levels that meet state and federal drinking water standards
- Mitigate, to the extent practicable, the migration and potential migration of contaminated waters through the site sewers
- Eliminate, to the extent practicable, the direct contact threat associated with contaminated soil, surface water and groundwater

- Reduce, to the extent practicable, the level of contaminants in surface water and sediments to attain surface water Applicable or Relevant and Appropriate Requirements (ARARs) and sediment remedial goals to be protective of fish, wildlife, and the resources upon which they depend

Under direction of the NYSDEC and Honeywell, the remediation of LCP included closing a sewer system, removing mercury from soil on the former plant property, excavating impacted sediments in surrounding areas and relocating them to the soil/sediment containment area, constructing an underground cut-off wall, and installing an on-site groundwater collection system. The low-permeability final cover area design is currently in progress. As part of the site remediation, excavation areas were restored to provide habitats for wading birds, ducks, amphibians, fish, and mammals. Remedial construction activities and site restoration are described in the Final Remedial Action Report for the Soil Washing, Soil and Sediment Consolidation, Sewers, Slurry Wall, Groundwater Containment/Pretreatment And Interim Soil Cover at the LCP Bridge Street Site (OU 1) (Parsons 2009b).

Sediment analytical results collected as part of OM&M activities in 2008 indicated higher than anticipated mercury concentrations in Wetland A. Additional sediment samples were collected in May and October 2009 to determine if there was a previously unidentified mercury source nearby. The results of this sampling found elevated mercury concentrations in soils/sediments in the West Ditch, which discharges to Wetland A. The West Ditch had not been fully remediated as part of the remedial action completed in 2007. The results of this sampling also found elevated mercury concentrations in soils/sediments north of and adjacent to the West Flume. Historical practices and topographic characteristics of this area suggested the soils/sediments were likely associated with spoils generated in the 1970s during dredging of the West Flume. A second round of sampling was conducted in June 2010 to fully delineate the affected area.

In fall 2010, impacted sediments in the drainage ditch around the east side of the cap area (East Ditch) were removed prior to construction of the Geddes Brook/Ninemile Creek construction wastewater treatment plant (CWTP). Removed sediment from the East Ditch Area and confirmatory sample results from those sediments were detailed in the 2010 Annual OM&M report for the site (Parsons 2013a). Impacted sediments in the drainage ditch around the west side of the cap area (West Ditch), Wetland A, and the Dredge Spoils Area were removed in Fall 2011 and Spring 2012. Sediment removals and subsequent restoration details were summarized in the 2011 and 2012 Annual OM&M Reports (Parsons 2013b and 2013c, respectively). Figure 2 depicts soil/sediment removals that were completed between 2010 and 2012.

3.0 OM&M ACTIVITIES AND RESULTS

Following the completion of the remediation tasks described above, the OM&M program was initiated in August 2008 after a brief start-up period. OM&M activities since startup have consisted of site and equipment maintenance in addition to monitoring of groundwater, sediment, surface water, wetlands, and mercury concentrations in biota. These OM&M monitoring activities are summarized in Table 1. OM&M results and conclusions are presented below and in

Appendix A. Recommendations for future monitoring based on these results are presented in Section 4.

3.1 Site Inspections and Groundwater Extraction System Operations

Since startup in January 2008, approximately 100,000 gallons of groundwater have been removed from inside the containment area each month. The groundwater pumping rate will be re-evaluated once the final low-permeability cap is installed and infiltration is reduced. Groundwater extracted by the 15 pumping wells within the soil/sediment cover area is pumped to two 10,000-gallon tanks in the on-site extraction building (Figure 3). Water collected was initially trucked from the LCP site to the Willis Avenue Wastewater Treatment Plant. On January 21, 2010, the LCP pre-treatment system began operation. The pre-treatment system consists of a filter feed pump, two 5-micron bag filters, two fiberglass-reinforced plastic granular activated carbon vessels, and a flow meter. In addition, a pipeline was installed from the pre-treatment system directly to the Onondaga County West Side Trunk Sewer, which flows to the Onondaga County Metropolitan Wastewater Treatment Facility (METRO).

Water levels have remained generally consistent and always below the elevation of the top of the cut-off wall since startup in January 2008. It is expected to take several years after the final low-permeability cap is constructed to fully achieve an inward gradient at the site. Groundwater elevations are monitored using the piezometer and monitoring well network shown in Figure 3. A vibrating wire pressure sensor in each of the 42 piezometers transmits head pressure (water level) to a data logger in one of the Remote Utility Buildings. In addition, manual water level measurements were collected and recorded every two weeks and reported to the NYSDEC in the monthly reports.

Groundwater analytical data indicate that the system is effectively containing contaminated groundwater. Quarterly groundwater samples are collected from the 42 piezometers around the perimeter of the containment area and from the three downgradient monitoring wells. The piezometers and monitoring wells are inspected for evidence of elemental mercury, and none was observed during the sampling events. Collected groundwater samples are analyzed for total mercury. The analytical results for the exterior groundwater samples were predominantly non-detect and generally within the same range or lower than the pre-remediation mercury results presented in the RI for the LCP OU-1 site.

Routine inspections and monitoring of the groundwater extraction system at the landfill area will continue in the final cover area. Inspection and maintenance of the site grounds and groundwater extraction system included system equipment maintenance, mowing, and snow removal, inspection of general site conditions (i.e., access roads, security fence/gates, signs, erosion control measures) and groundwater collection/storage system condition (i.e., building structure, extraction wells, piezometers, pumps, instrumentation, storage tanks). Maintenance conducted to system equipment was described in the weekly inspection, operation and monitoring reports generated by CH2MHILL OMI and submitted to the NYSDEC and associated distribution list with the monthly reports for the LCP OU-1 site.

3.2 Site Surface Water

As discussed in Section 2.0 the RAO for surface water is to: reduce, to the extent practicable, the level of contaminants in surface water to attain surface water ARARs and to be protective of fish, wildlife, and the resources upon which they depend.

As shown on Figure 4, surface water samples have been collected annually from two locations in Wetland A, three locations in Wetland B, and four locations in the West Flume. Collected samples have been analyzed for total mercury, total dissolved mercury (not analyzed in 2008), and methylmercury. Total dissolved mercury is the primary component used to ascertain remedial goals related to surface water. Total mercury and methylmercury provide ancillary information useful for understanding the dissolved results. Overall, there has been a substantial reduction in average dissolved mercury since implementation of the remedy, and these results have been largely maintained throughout the monitoring period (Figures 5a and 5b). Mean and maximum dissolved mercury concentrations reported in the RI for the wetland areas were 1,998 ng/L[1] and 2,838 ng/L, respectively, while concentrations in the West Flume were 1,285 ng/L and 2,252 ng/L. Mean dissolved mercury concentrations in 2013 ranged from 3.97 ng/L to 0.92 ng/L, and all areas are now well below both the acute (1,400 ng/L) and chronic (770 ng/L) aquatic standards. With the exception of Wetland A, analytical results have generally remained below the 2.6 ng/L standard for protection of wildlife since monitoring began in 2009. Although concentrations in Wetland A have been higher than other areas in most years, this area had the lowest average concentration of all the areas in 2013. The average concentration was 0.92 ng/L, well below the goal of 2.6 ng/L.

3.3 Wetland Sediment

As discussed in Section 2.0 one of the remedial action objectives (RAOs) for the LCP site is to: reduce, to the extent practicable, the level of contaminants in sediments to attain sediment remedial goals to be protective of fish, wildlife, and the resources upon which they depend. The NYSDEC Technical Guidance for Screening of Contaminated Sediments guidance values for mercury is 0.15 mg/kg[2] (lowest effects level [LEL]) and 1.3 mg/kg (severe effect level [SEL]).

During the monitoring period, nine annual monitoring locations were co-located with the surface water sample locations and analyzed for total mercury and methylmercury (Figure 4). Mean and maximum mercury concentrations were reported in the RI for the wetland areas (referred to as the "ponded area" in the RI report) and the West Flume. Mean mercury concentrations reported in the RI for the wetland areas were 18 mg/kg, with a maximum concentration of 131 mg/kg; and 33 mg/kg, with a maximum concentration of 48 mg/kg in the West Flume. As shown on Figures 6a and 6b, a decline in mean mercury concentrations in wetland areas and the West Flume can be inferred.

[1] Ng/L – nanogram per liter
[2] mg/kg – Milligram per kilogram

In 2013, mean mercury concentrations ranged from 1.08 to 0.09 mg/kg in the wetlands and the West Flume and are now below the SEL (1.3 mg/kg) in all four monitoring areas and most individual sampling locations (Figures 6a and 6b). In addition, sediments in Wetland B are now below the background concentration noted in the RI (0.2 mg/kg) and the LEL (0.15 mg/kg).

3.4 Wetland Restoration Monitoring

Restored areas that were previously dominated by a monoculture of the invasive common reed with little habitat value are now diverse wetlands that support a diversity of plant and animal species (including a nesting population of the State–listed, pied-billed grebe). The improvement in habitat value of these areas is significant, and wildlife usage of the restored areas is extensive. For example, the number of native plant species recorded each year increased steadily from 77 species in 2008 (the first year after restoration) to 97 in 2009, 115 in 2010, 148 in 2011, and 155 in 2012 (Figure 7). Comprehensive wetlands reports for each year can be found in Appendix B of each year's annual report (including the Year 5 report found in Appendix B of this report).

3.5 Site Biota

Mercury concentrations in prey fish and crayfish have remained generally consistent since 2009 and are considerably lower than concentrations measured in the 1995 RI (Figure 8). Mercury concentrations in earthworms have stabilized and are unlikely to be of concern to worm consumers like the short-tailed shrew. The baseline ecological risk assessment (TAMS 1998) calculated risk to shrew based on both mean and maximum mercury concentrations in soil. The hazard quotients calculated in the risk assessment were less than 1.0 and therefore not of concern. Mercury concentrations in mice have been and continue to be low or below the level of detection.

4.0 CONCLUSIONS

A comparison of monitoring data against pre-remedy mercury levels indicate the remedy implemented at the LCP site has been effective at reducing the levels of mercury in surface water, sediment, and biota.

4.1 Surface Water

The results of surface water monitoring activities show that remedial goals have been met to the extent practicable and surface water monitoring is no longer a necessary component of the routine monitoring program at historically monitored areas. Specifically, surface water concentrations are well below the acute and chronic standards for protection of aquatic life, and the surface water standard of 2.6 ng/L has been met in each monitored area. Surface water monitoring will be conducted in the former Dredge Spoil Area (now referred to as Wetland C) to verify remedy effectiveness where additional removals occurred in 2011 and 2012 until remedial goals are met.

4.2 Sediments

Mercury sediment concentrations in Wetland B are meeting all RAOs including the 0.15 mg/kg sediment screening criteria. Sediment sampling should continue in Wetland A and be initiated in the Wetland C to verify the effectiveness of the sediment removals that occurred in both areas in 2011 and 2012. Sediment monitoring should also continue in the West Flume due to its proximity to Wetland C and because it serves as the connection to downstream locations such as Geddes Brook and Ninemile Creek.

4.3 Biota

While there are no remedial goals for tissue, a dramatic decrease in mercury concentrations in sediment and surface water since the RI clearly demonstrates remedy effectiveness. Therefore, biota monitoring can be discontinued.

4.4 Wetland Restoration

Wetland hydrology and habitat have been successfully established and maintained over the six year monitoring period in Wetlands A and B (Figure 9). The success of wetland restoration efforts led NYSDEC to agree that intensive monitoring in Wetland B and most of Wetland A was no longer necessary after 2012. The monitoring efforts were refocused on the newly restored Wetland C and a small area of Wetland A where additional material was removed in 2011 and habitat restored in 2012.

5.0 RECOMMENDATIONS

Table 2 summarizes the recommended monitoring program that would begin in 2014 and be reviewed annually. Such elements as locations, methods, and analytes will follow the approved OM&M Plan (Parsons 2009b) unless otherwise noted. Proposed locations for areas where new sampling is recommended are depicted in Figure 10.

- No changes are recommended for the Containment Area and Cap.
- The following two monitoring activities are recommended for Wetland A:
  - Continue annual sediment monitoring until the effectiveness of additional removals can be verified
  - Conduct restoration monitoring and maintenance for a five-year period beginning in 2013 in areas where additional removals occurred in 2011 and 2012.
- Routine monitoring can be discontinued in Wetland B.
- Continue sediment monitoring in the West Flume.
- Continue surface water and sediment sampling annually at the three Wetland C (Dredge Spoils Area) sites shown in Figure 11. Surface water samples should be analyzed for total mercury, total dissolved mercury, and methylmercury. Sediment samples should be analyzed for total mercury and methylmercury.

6.0 REFERENCES

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TAMS Consultants, Inc. 1998. *New York State Revision of the Baseline Ecological Risk Assessment Prepared by AlliedSignal, Inc. (September 1997).* Prepared for NYSDEC, Division of Environmental Remediation, Albany, New York.

TABLES

Table 1
LCP OM&M Sampling Summary

Component	Location	Parameters	Sample type	# Samples	Frequency	Notes
Cut-off wall	cut-off wall alignment	evidence of vehicle crossings at undesignated locations	visual	1	monthly	
		settling or damage to the augmented clay cap		1		
	designated wall crossing	erosion or damage		1		
	cut-off wall	settlement or damage to the cut-off wall		1		
Hydraulic Containment	42 piezometers	Water level	water level	1 per pz (42 total)	Twice per month	OMM plan indicates auto data collection. PZ's found to have interference so manual recording undertaken.
Groundwater Plume	12 piezometers	Mercury	discrete water sample	1 per pz (12 total)	quarterly	
	3 downgradient wells			1 per well (3 total)		If Hg detected, affected wells resampled. If confirmed sample three consecutive months
Sediment	West flume (4 stations)	THg, MHg	sediment composite five grab samples from top 6 inches of sediment	4 (1@each station)	annually	
	Wetland A (2 stations)			2 (1@each station)		
	Wetland B (2 stations)			3 (1@each station)		
Surface Water	West flume (4 stations)	THg, TDHg, MHg	discrete water sample	4 (1@each station)	annually	Field parameter also collected. Same locations as sediment samples.
	Wetland A (2 stations)			2 (1@each station)		
	Wetland B (2 stations)			3 (1@each station)		
Wetlands field reconnaissance	Wetland A &B	Vegetation establishment	observations	multiple	annually for min. of five years	Final report (fifth year; 2012) will identify trends and evaluate hydrologic conditions and project whether these conditions will be sustained in the future. * Wetland Report indicates 18 plots being monitored and that plant species observed and percent cover of each species documented.
		Wildlife usage	observations			
		Surface water level	observations	1		
Wetland Plot Sampling	Wetland A &B	Cover type	Herbaceous: 10'x10' plots Woody: 20'x20' plots	6-9 plots total*		
		Percent Cover*				
		Frequency				
		Photographs				
		Wildlife usage	observations			
		Surface water level				
		Invasive Control	-	-	annually for max of five years	
Forage Fish	West Flume-Reach A	THg	composite by species	5	yrs 1 &2 then every 2 to 3 yrs	After 3-4 rounds of sampling review to detemine if sampling to be extended or concluded. OMI collects samples and Parsons or sub ID's, processes and ships samples.
	West Flume-Reach B			5		
	West Flume-Reach C			5		
Benthic Macroinvertebrate	West Flume-Reach A	THg, MHg(?)	composite from grab sample and/or nets	2	yrs 1 &2 then every 2 to 3 yrs	After 3-4 rounds of sampling review to detemine if sampling to be extended or concluded. OMM Plan indicates that certain samples may be split in the lab and analyzed for MHg. OMI collects samples and Parsons or sub ID's, processes and ships samples.
	West Flume-Reach B			2		
	West Flume-Reach C			2		
	Wetland A			3		
	Wetland B			3		
Small Mammals	Area surrounding Wetlands A/B and West Flume	THg	individuals or composite of same species	5	yrs 1 &2 then every 2 to 3 yrs	After 3-4 rounds of sampling review to detemine if sampling to be extended or concluded. OMM Plan indicates that certain samples may be split in the lab and analyzed for MHg. OMI collects samples and Parsons or sub ID's, processes and ships samples.
Earthworms	Up to 3 locations adjacent to Wetlands A/B and West Flume	THg	composite	1 per location	yrs 1 &2 then every 2 to 3 yrs	After 3-4 rounds of sampling review to detemine if sampling to be extended or concluded. OMM Plan indicates that certain samples may be split in the lab and analyzed for MHg. OMI collects samples and Parsons or sub ID's, processes and ships samples.

Table 2
LCP Recommended OM&M Sampling and Monitoring Changes

Component	Location	Parameters	Sample type	# Samples	Frequency	Notes
Cut-off wall	cut-off wall alignment	evidence of vehicle crossings at undesignated locations	visual	1	monthly	
		settling or damage to the augmented clay cap		1		
	designated wall crossing	erosion or damage		1		
	cut-off wall	settlement or damage to the cut-off wall		1		
Hydraulic Containment	42 piezometers	Water level	water level	1 per pz (42 total)	Twice per month	
Groundwater Plume	12 piezometers	Mercury	discrete water sample	1 per pz (12 total)	quarterly	
	3 downgradient wells			1 per well (3 total)		If Hg detected, affected wells resampled. If confirmed sample three consecutive months
Sediment	West flume (4 stations)	THg, MHg	sediment composite five grab samples from top 6 inches of sediment	4 (1@each station)	annually	
	Wetland A (2 stations)			2 (1@each station)		
	Wetland C (3 Stations)			3 (1@each station)		
Surface Water	Wetland C (3 Stations)	THg, TDHg, MHg	discrete water sample	3 (1@each station)	annually	Field parameter also collected. Same locations as sediment samples.
Wetlands field reconnaissance	Wetland A (where additional removals occurred) and Wetland C	Vegetation establishment	observations	multiple	annually	Surface water levels from April-October in Wetland C only
		Wildlife usage	observations			
		Invasive Species Location	observations			
Wetland Plot Sampling	Wetland A (where additional removals occurred) and Wetland C	Cover type	Herbaceous: 10'x10' plots Woody: 20'x20' plots	2 plots in Wetland A and 11 plots in Wetland C		
		Percent Cover*				
		Frequency				
		Photographs				
		Wildlife usage	observations			
		Surface water level			Twice per month	
		Invasive Control	-	-	annually for max of five years	

Note: Highlighted areas are recommendations for future sampling.

FIGURES

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FIGURE 1

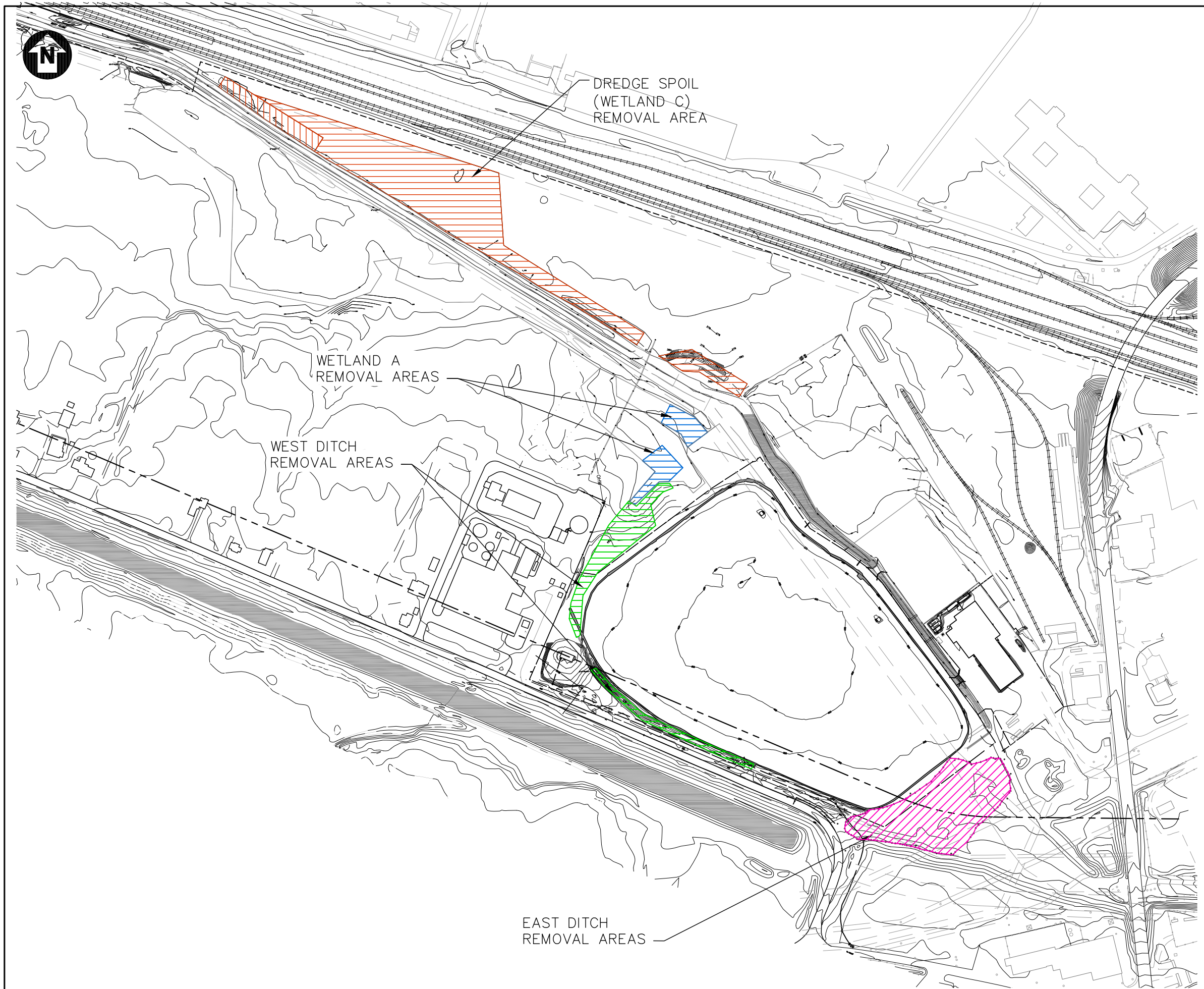
Honeywell

LCP BRIDGE STREET SITE
SYRACUSE, NY

LCP SITE PLAN

PARSONS
301 PLAINFIELD ROAD * STE 350 * SYRACUSE, NY 13212 PHONE: (315) 451-9560

P:\H-WELL-SYR\448308\10.0\CAD\FIGURES\SLM\LCP SITE PLAN.PPTX



300 150 0 300 600

SCALE: 1"=300'

PRELIMINARY DRAFT
SETTLEMENT CONFIDENTIAL
NOT INTENDED FOR PUBLIC REVIEW

FIGURE 2

Honeywell

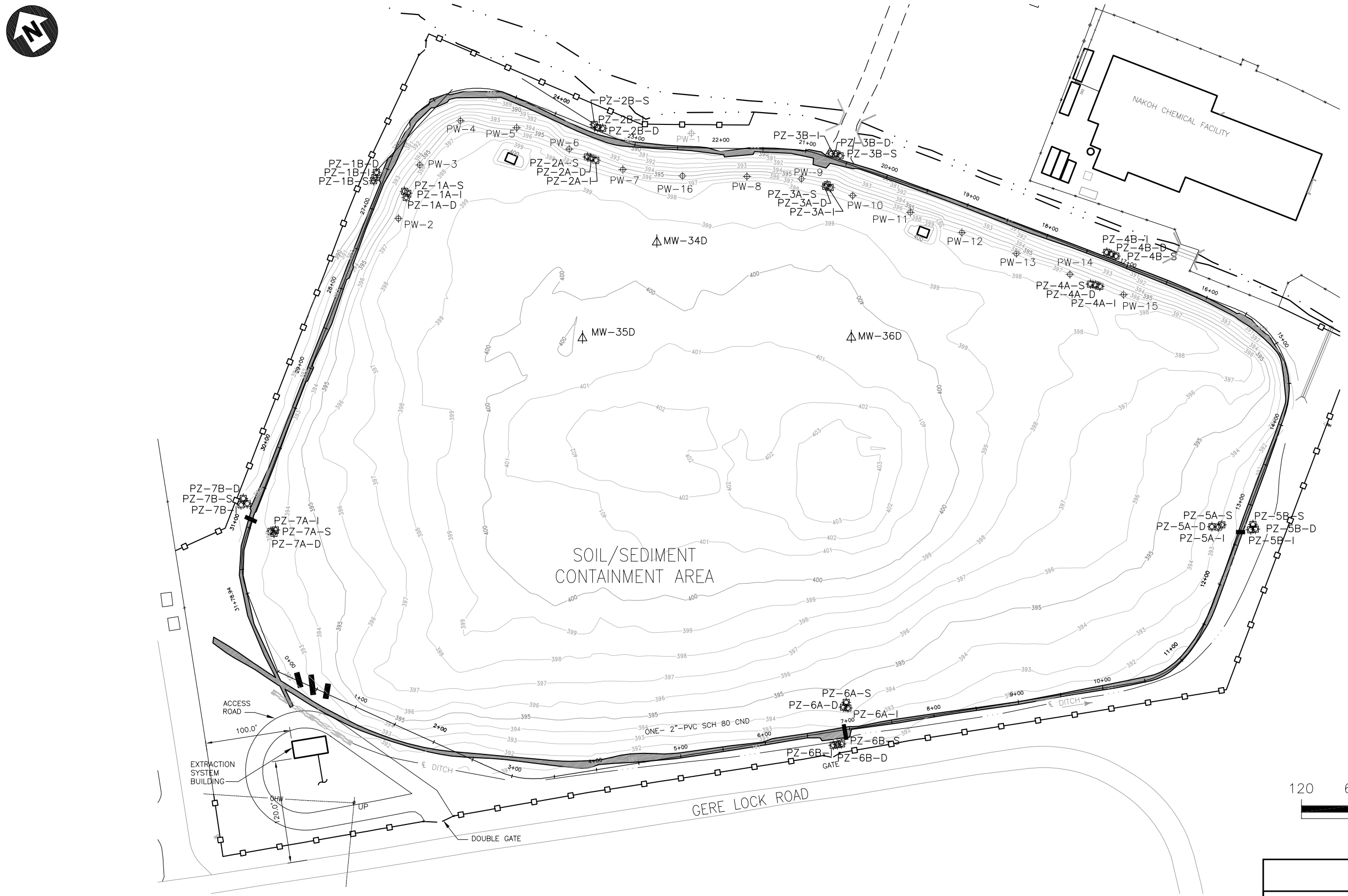
FORMER LINDEN CHEMICAL PLANT
SOLVAY, NEW YORK

ADDITIONAL SOIL/SEDIMENT REMOVALS

PARSONS

301 PLAINFIELD ROAD, SUITE 350, SYRACUSE, N.Y. 13212, PHONE: 315-451-9560

FILE NAME: P:\HONEYWELL -SYR\448308 - LCP OU1 2013\10.0 -TECHNICAL\CAD\FIGURES\NEW FOLDER (2)\448308-SK001.DWG
PLOT DATE: 5/30/2014 2:17 PM PLOTTED BY: RUSSO, JILL



LEGEND:

- PUMPING WELL LOCATIONS
- PIEZOMETER LOCATIONS
- GROUNDWATER MONITORING WELL LOCATIONS

120 60 0 120 240

SCALE: 1"=120'

FIGURE 3

Honeywell FORMER LINDEN CHEMICAL PLANT
SOLVAY, NEW YORK

PIEZOMETER/MONITORING WELL LOCATIONS

PARSONS
301 PLAINFIELD ROAD, SUITE 350, SYRACUSE, N.Y. 13212, PHONE: 315-451-9560

FILE NAME: P:\HONEYWELL -SYR\444224 LCP OU1 2008\10 TECHNICAL CATEGORIES\10.1 CAD\ANNUAL REPORT-2009\444224-RPT010.DWG
PLOT DATE: 2/4/2014 9:36 AM PLOTTED BY: RUSSO, JILL

NEW YORK STATE FAIR GROUNDS

HANLIN GROUP, INC. 10.1

MATLOW COMPANY, INC. LOT 01.1

NORTH DITCH EXCAVATION AREA

WEST FLUME EXCAVATION AREA

LCP1-SW-61

REACH B

REACH A

BRINE MUD AREA

LCP1-SW-62

OU-2

ORONZO SUSCO LOT 02.1

NAKOH CHEMICAL CO. INC. LOT 10.5

REACH C

EXISTING ACCESS ROAD (UNPAVED)

CULVERT #5

CULVERT #6

LCP1-SW-60

LCP1-SW-65

LCP1-SW-64

LCP1-SW-66

LCP1-SW-67

MW-26 EXCAVATION AREA

LCP1-SW-68

WETLAND A EXCAVATION AREA

WETLAND B EXCAVATION AREA

SOIL/SEDIMENT CONTAINMENT AREA

LCP1-SW-63

HANLIN GROUP, INC. 09.2

HORAN ROAD (DO NOT USE)

HANLIN GROUP, INC. 09.2

HANLIN GROUP, INC. 10.1

HANLIN GROUP, INC. 10.1

GEDDES BROOK

RESIDENTIAL LOTS

RESIDENTIAL LOTS 06, 08, 09.1

HORAN ROAD

TOWN OF GEDDES VILLAGE OF SOLVAY

TOWN OF GEDDES VILLAGE OF SOLVAY

BELLE ISLE ROAD

MATTHEWS AVE

300 150 0 300 600

SCALE: 1"=300'

LEGEND:

SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS

FIGURE 4

Honeywell

FORMER LINDEN CHEMICAL PLANT
SOLVAY, NEW YORK

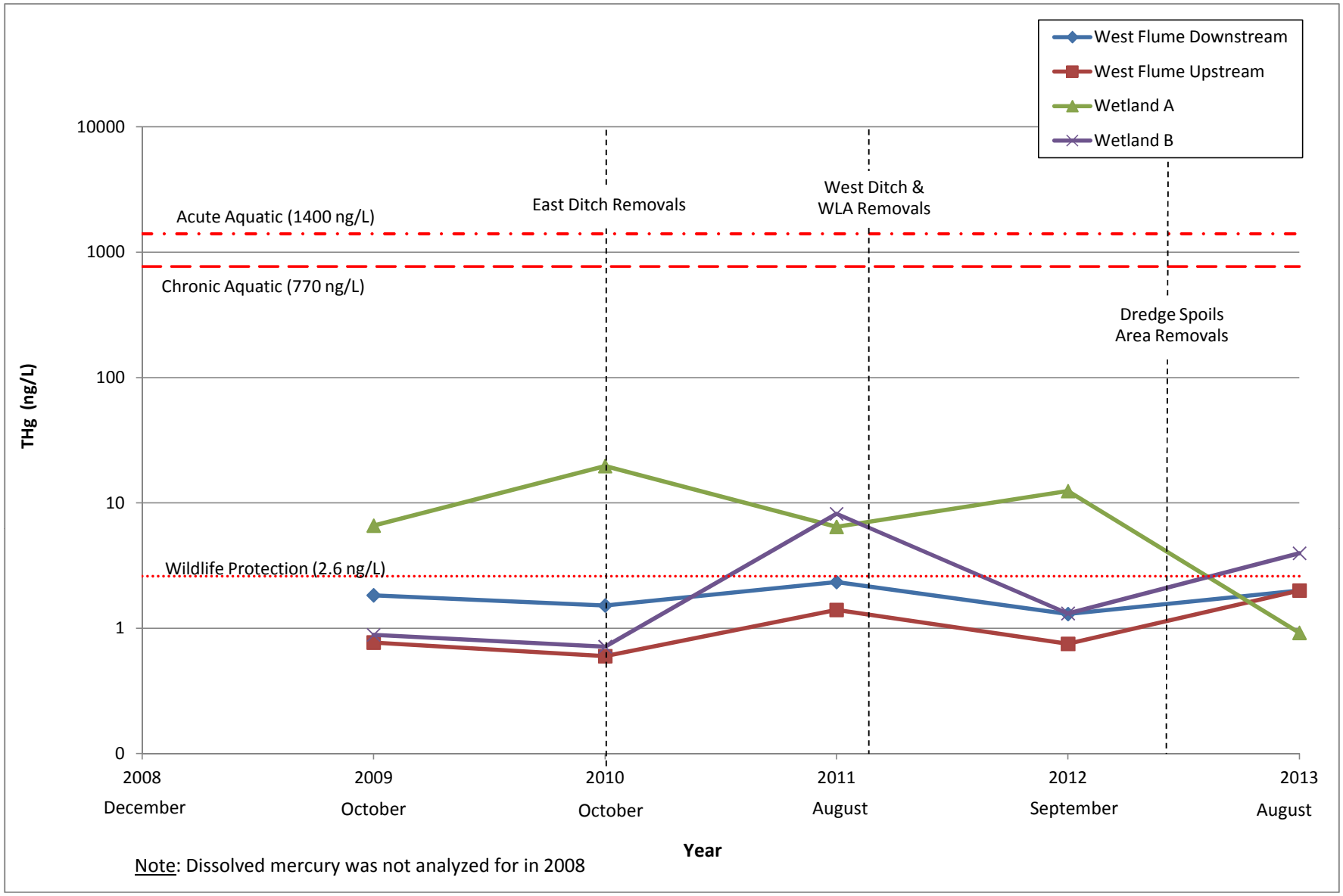
2008-2013 SURFACE WATER/SEDIMENT SAMPLING LOCATIONS

PARSONS

301 PLAINFIELD ROAD, SUITE 350, SYRACUSE, N.Y. 13212, PHONE: 315-451-9560

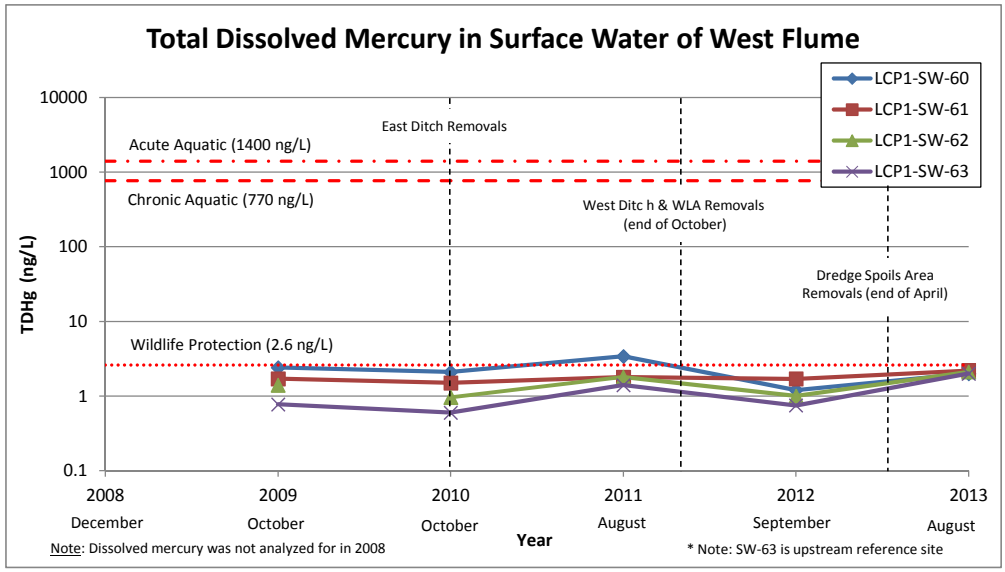
FILE NAME: P:\HONEYWELL -SYR\448308 - LCP OU1 2013\10.0 -TECHNICAL\CAD\FIGURES\NEW FOLDER (2)\448308-SK002.DWG
PLOT DATE: 2/6/2014 2:58 PM PLOTTED BY: RUSSO, JILL

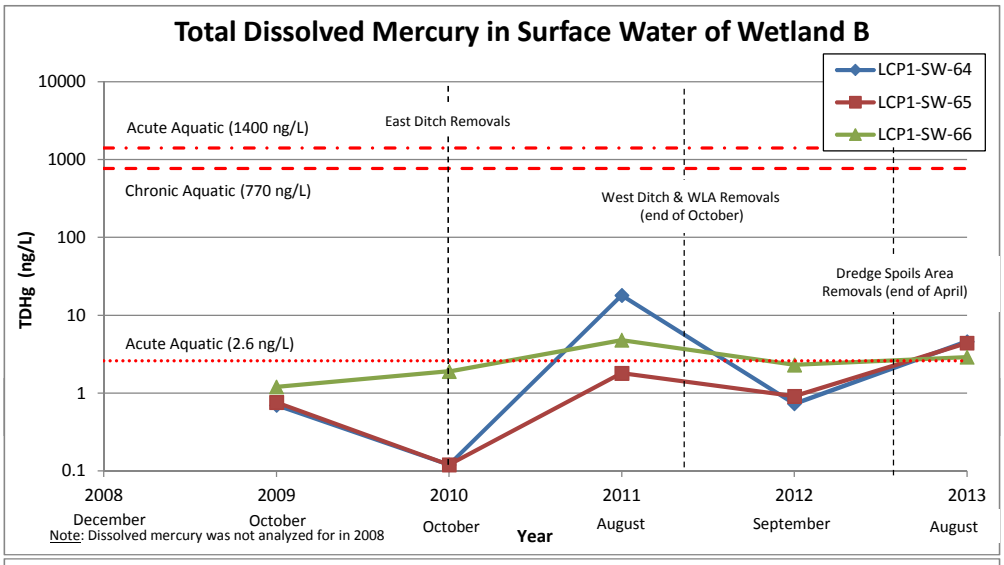
Figure 5a
Average Dissolved Mercury in Surface Water



Note: Dissolved mercury was not analyzed for in 2008

Figure 5b
Total Dissolved Mercury Trends in Surface Water 2009-2013





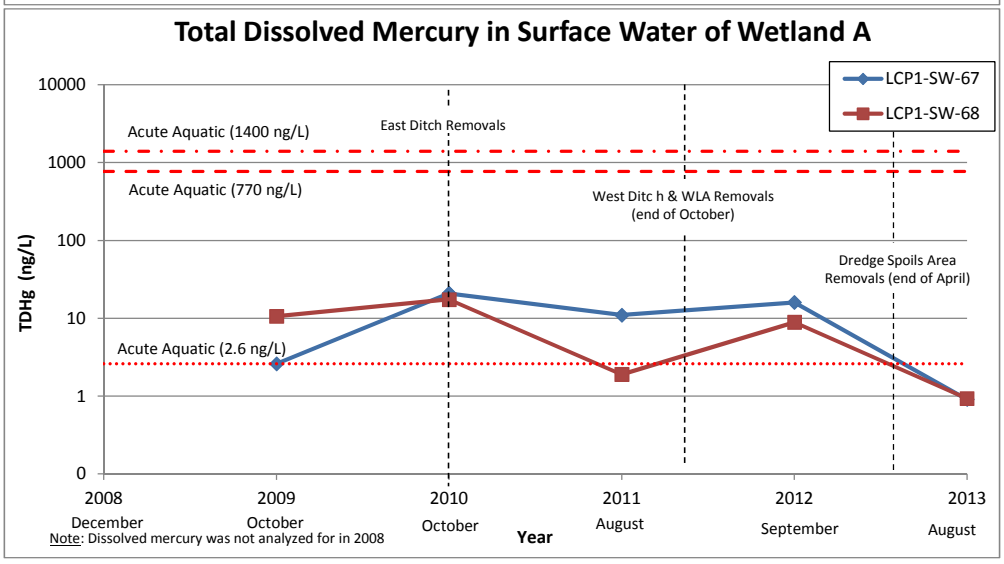


Figure 6a
Average Total Mercury in Sediment

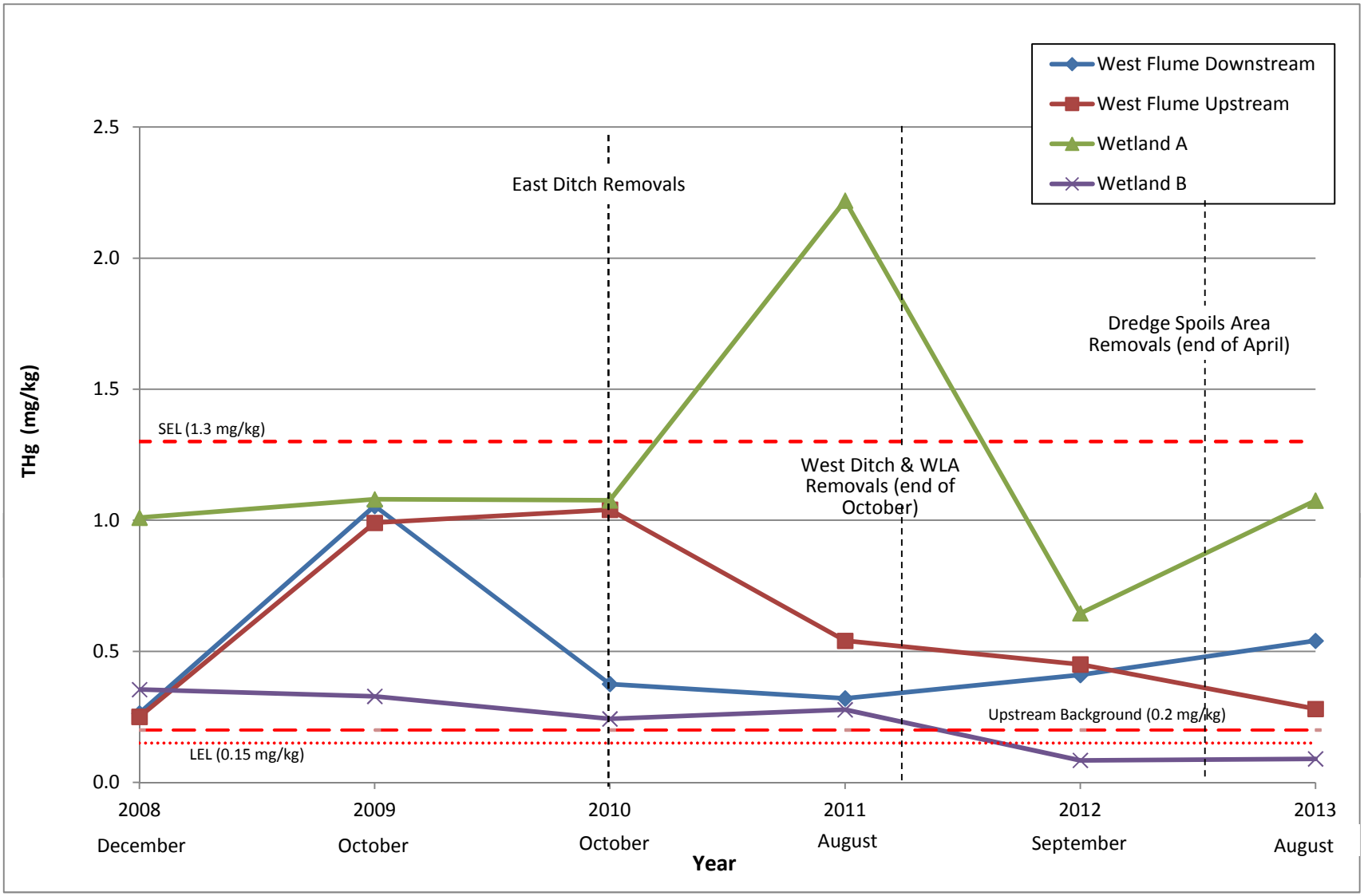
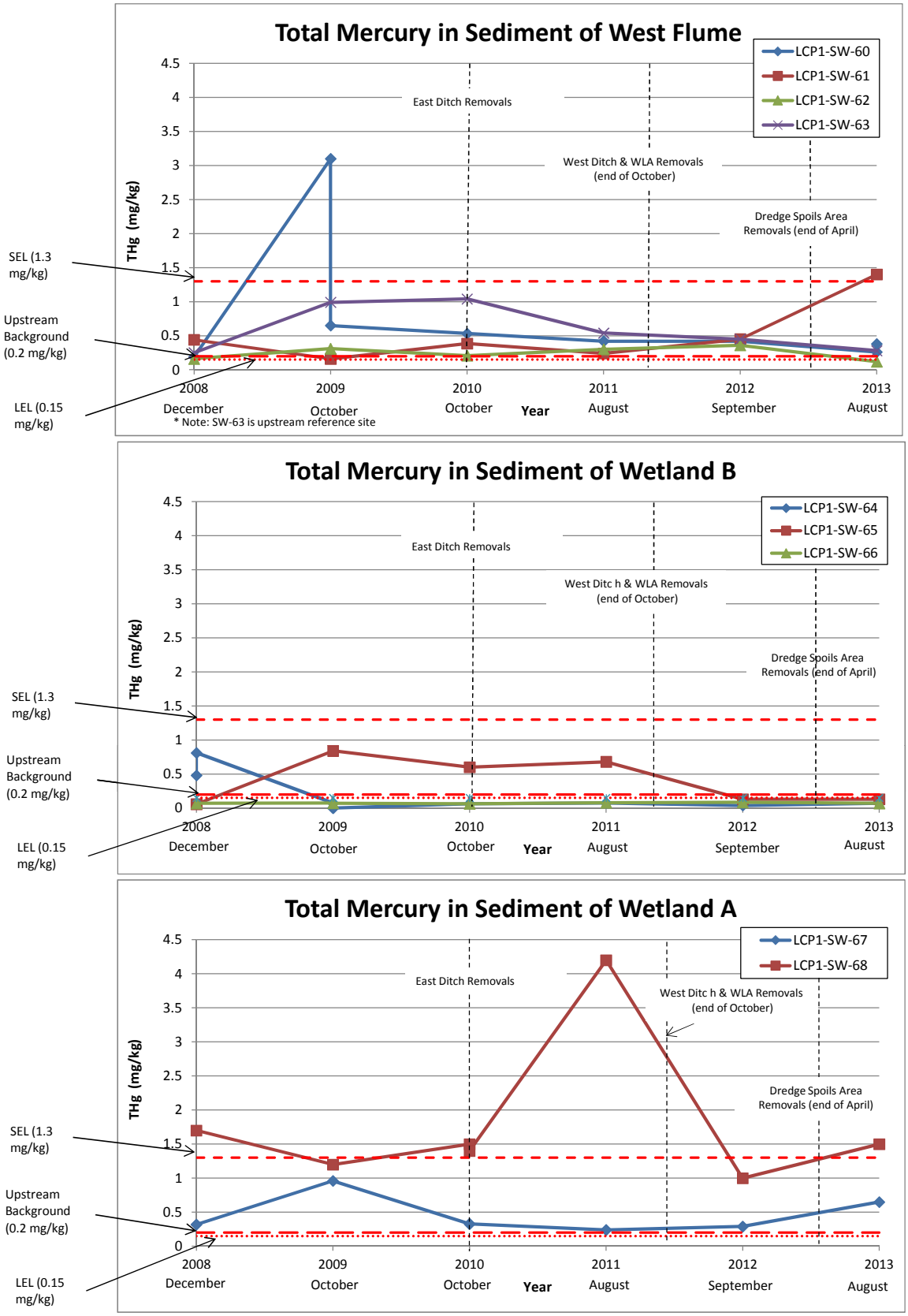
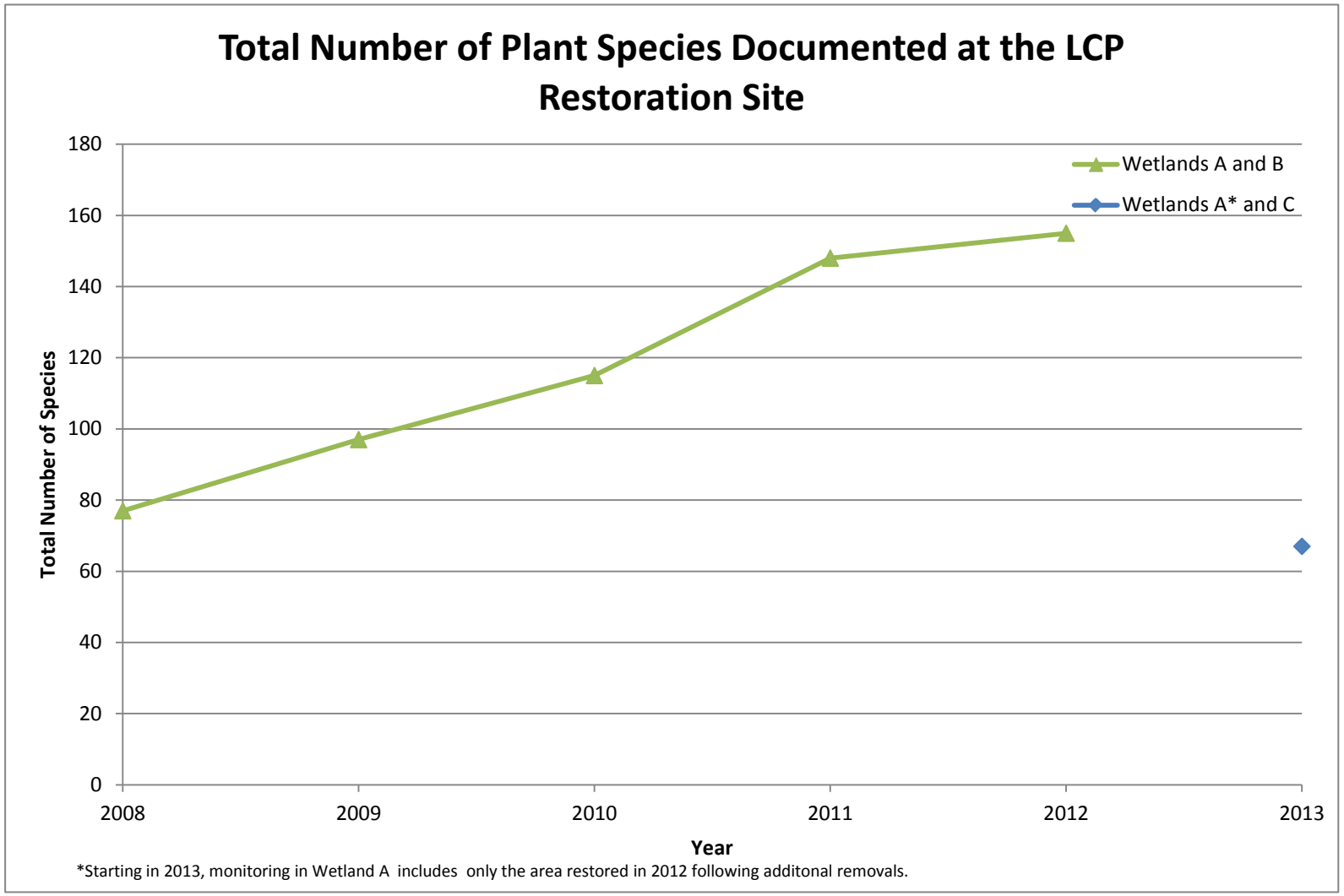


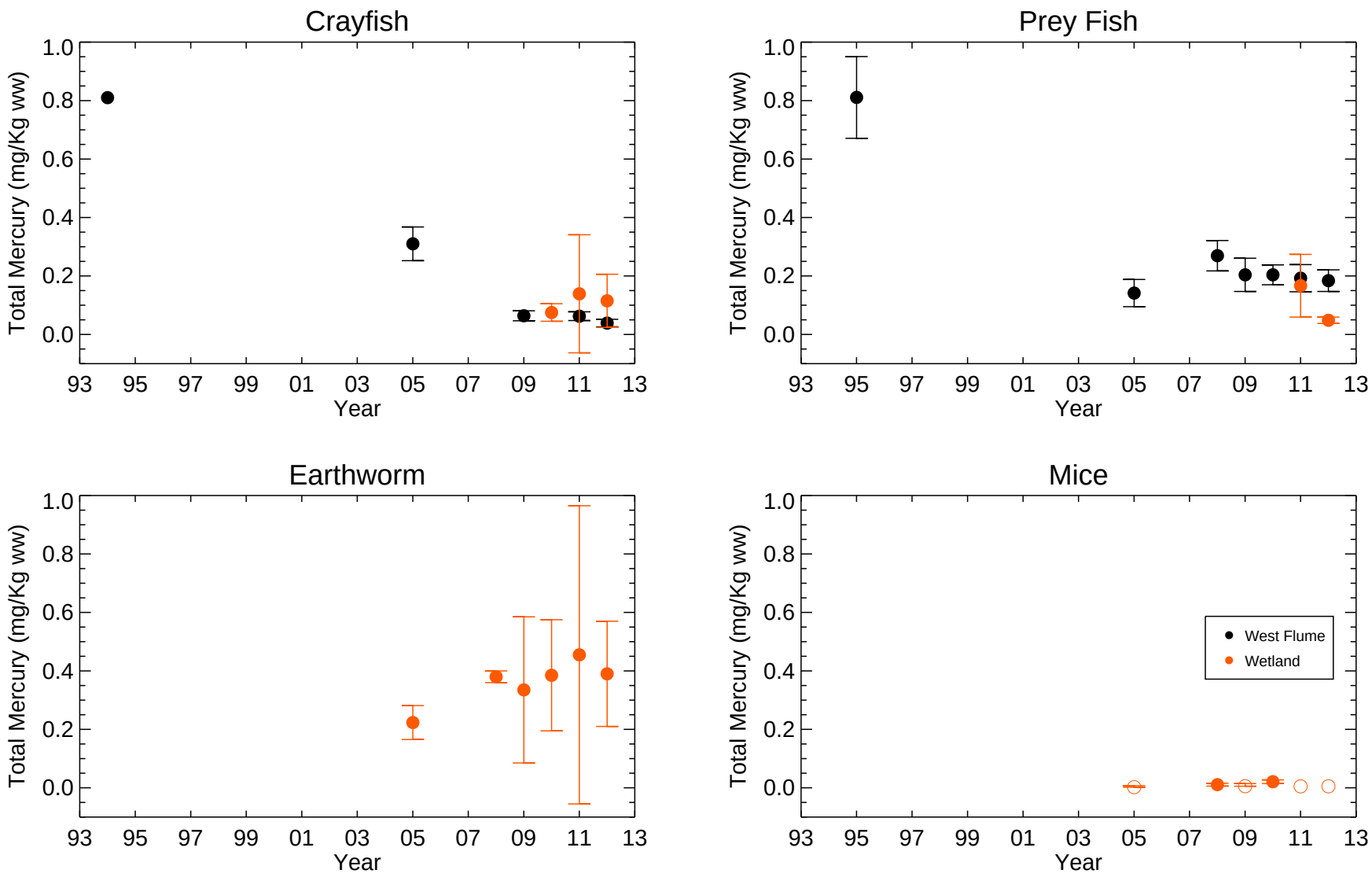
Figure 6b
Total Mercury Trends in Sediment 2008-2013



Note: Locations with two sample results for the sample sample period indicate a duplicate sample was collected.

Figure 7
Total Number of Plant Species Documented
2008-2013





DRAFT - PRIVILEGED AND CONFIDENTIAL; ATTORNEY WORK PRODUCT

Figure 8

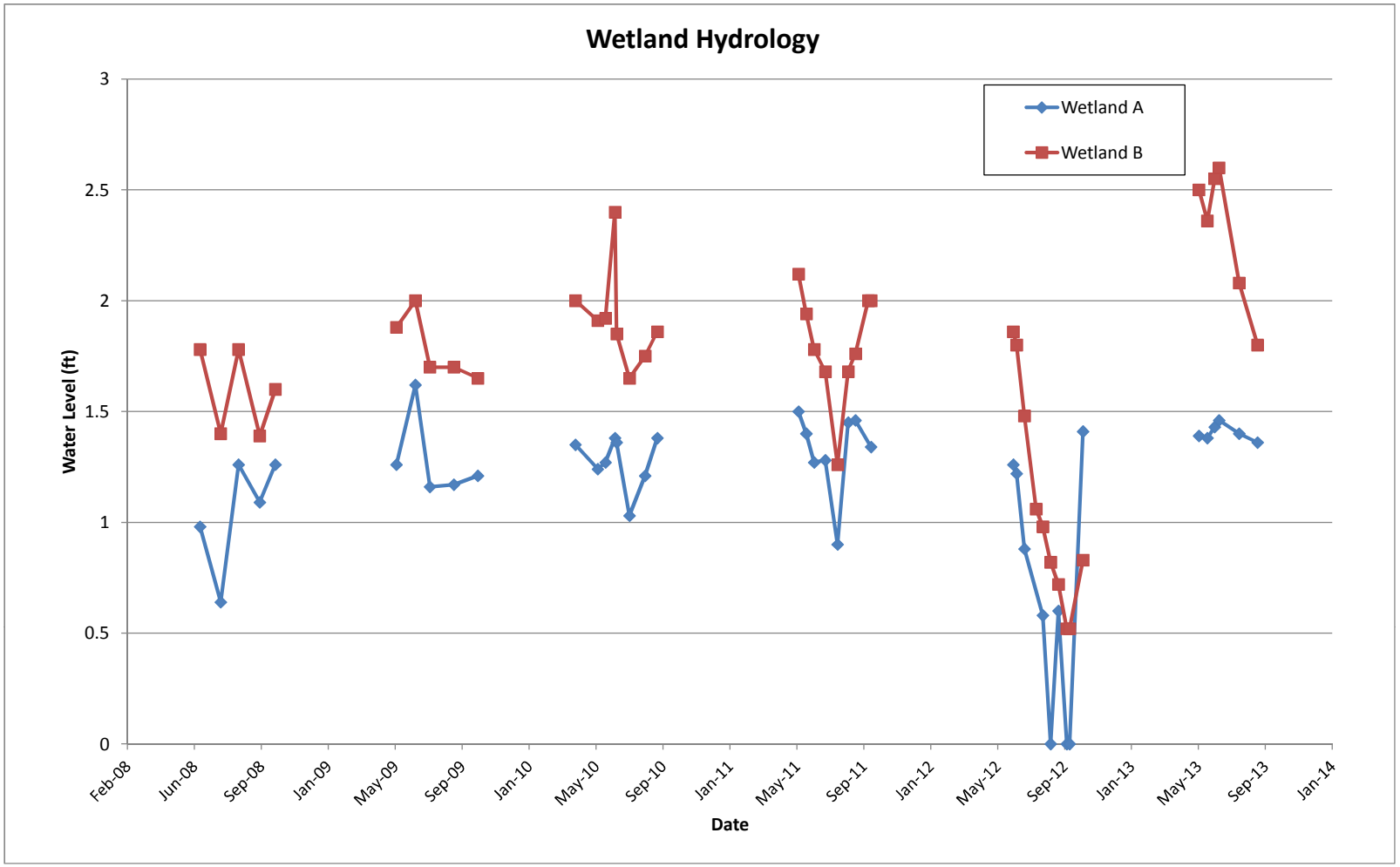
Average Total Mercury in Biota

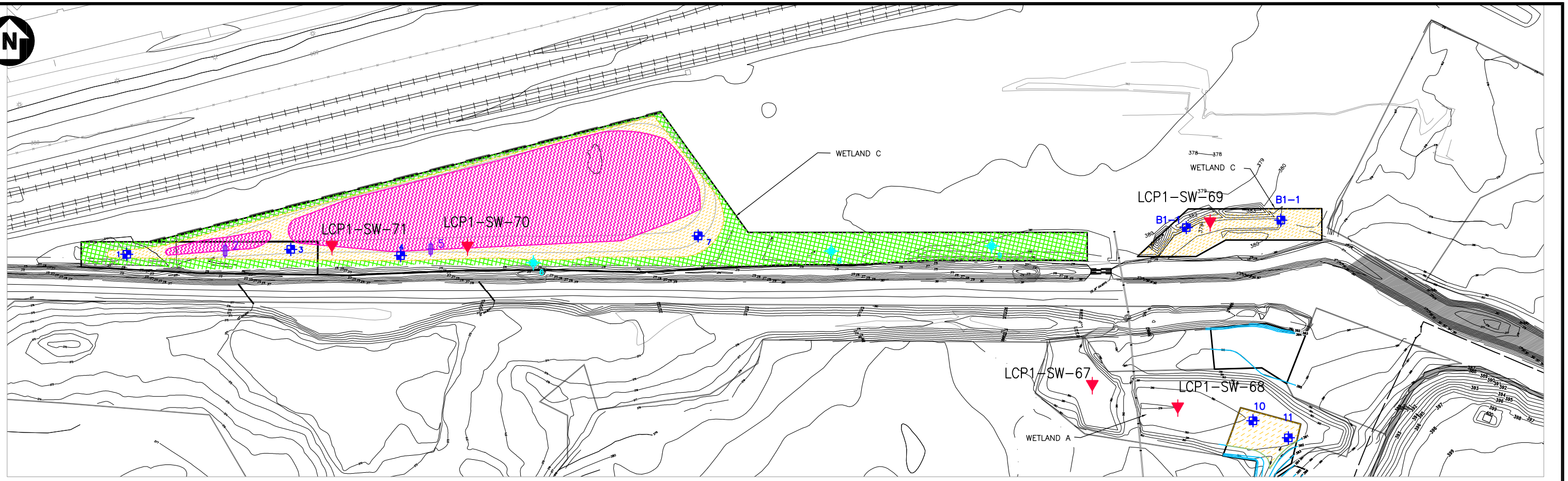
Note:Non-detects set to 1/2 the MDL before averaging.
Mice species includes Field Mouse, White Footed Mouse, Deer Mouse, and Meadow Vole.
Prey Fish species includes Brook Stickleback and Creek Chub.
Wetland samples were collected from Wetland A, Wetland B, or both.
Closed circles represent the sample mean, open circles represent the sample mean calculated from only non-detect results. Vertical lines show +/- 2 standard error of the mean.

ANCHOR QEA

KMB - D:\Projects\Honeywell\McAulliffe\Analysis\Biota\IDL\biota_analysis_12092013_stats_only.pro
Mon Feb 10 15:36:53 2014

Figure 9
Wetland A and B Water Levels





WETLAND GRADING/ PLANTING ZONES

ZONE A – WETLAND EDGES AND SIDE SLOPES
A–1: SIDE SLOPES
A–2: WETLAND EDGES

ZONE B – EMERGENT WETLAND

B–1: SHALLOW EMERGENT

B–2: DEEP EMERGENT

LEGEND

EXISTING CONTOURS

PROPOSED MONITORING LOCATIONS FOR A–1 AND A–2 ZONES (3)

PROPOSED MONITORING LOCATIONS FOR B–1 ZONES (8)

PROPOSED MONITORING LOCATIONS FOR B–2 ZONES (2)

SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS

150 0 150 300

SCALE: 1"=150'

FIGURE 10

Honeywell

PROPOSED WETLAND A & C OM&M MONITORING AND SAMPLE LOCATIONS

PARSONS
310 PLAINFIELD ROAD * SUITE 350 * SYRACUSE, NY 13212 * 315/451-9560
OFFICES IN PRINCIPAL CITIES

FILE NAME: P:\HONEYWELL –SYR\448308 – LCP OU1 2013\10.0 –TECHNICAL\CAD\FIGURES\NEW FOLDER (2)\448308–SK003.DWG
PLOT DATE: 6/19/2014 11:07 AM PLOTTED BY: RUSSO, JILL

APPENDIX A

LCP OU-1 OM&M SURFACE WATER, SEDIMENT DATA, AND BIOTA

SURFACE WATER ANALYTICAL RESULTS

	December 2008		May 2009	October 2009			October 2010			August 2011			September 2012			August 2013		
	Mercury	Methyl Mercury	Mercury	Mercury	Methyl Mercury	Dissolved Mercury	Total Mercury	Methyl Mercury	Dissolved Mercury	Total Mercury	Methyl Mercury	Dissolved Mercury	Total Mercury	Methyl Mercury	Dissolved Mercury	Total Mercury	Methyl Mercury	Dissolved Mercury
	Result ng/L	Result ng/L	Result ng/L	Result ng/L	Result ng/L	Result ng/L	Result ng/L	Result ng/L	Result ng/L	Result ng/L	Result ng/L	Result ng/L	Result ng/L	Result ng/L	Result ng/L	Result ng/L	Result ng/L	Result ng/L
West Flume																		
LCP1-SW-60	7.5 J	0.416	NA	7.9 J	3.01	2.4 J	6.0	0.35 J	2.1	3.4	0.19	3.4	8.6 J	0.26	1.2 J	38/37	0.38/0.41	2.0/1.7
LCP1-SW-61	6.9 J	0.104	NA	7.6 J	0.206	1.7 J	3.4	0.35 J	1.5	1.8	0.22	1.8	3.1	0.1	1.7	9.5	0.24	2.2
LCP1-SW-62	3.6 J	0.07	NA	9.7/5.2 J	0.166/0.162	1.4 J	3.9	0.35 J	1.0	4.5	0.17	1.8	3.1	0.17	1.0	7.3	0.20	2.1
LCP1-SW-63	2.8 J	0.023 J	NA	3.3 J	0.123	0.77 J	2.2	0.35 J	0.6	4.8	0.071	1.4	2.3	0.15	0.8	7.0	0.14	2.0
Wetland B																		
LCP1-SW-64	2.2 J	0.161	NA	1.3 J	0.724	0.7 J	0.5	0.35 J	ND (0.12) U	18.0 J	0.66	18 J	1.4	0.3	0.73	12	1.8	4.6
LCP1-SW-65	2.5 J	0.225	NA	2 J	0.783	0.76 J	0.5	0.35 J	ND (0.12) U	2.7	0.5 J	1.8 J	1.4	0.37	0.91	7.8	3.0	4.4
LCP1-SW-66	15.9 J	0.48	NA	11.4 J	1.48	1.2 J	4.7	0.35 J	1.9	4.9	0.62 J	4.8 J	8.0	0.58	2.3	6.6	0.59	2.9
Wetland A																		
LCP1-SW-67	65.7/72.5 J	1.27/1.18	NA	3.4 J	2.17	2.6 J	40.3/32	0.35/0.35	20.9/20.8	16	0.12 J	11 J	69	0.14	16	1.4	0.81	0.91
LCP1-SW-68	114 J	0.684	NA	24.7 J	6.39	10.6 J	61.8	0.35	17.4	29	0.18 J	1.9 J	29	6.2	8.9	1.2	0.60	0.93
LCP1-SW-69	NA	NA	130 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table Notes:

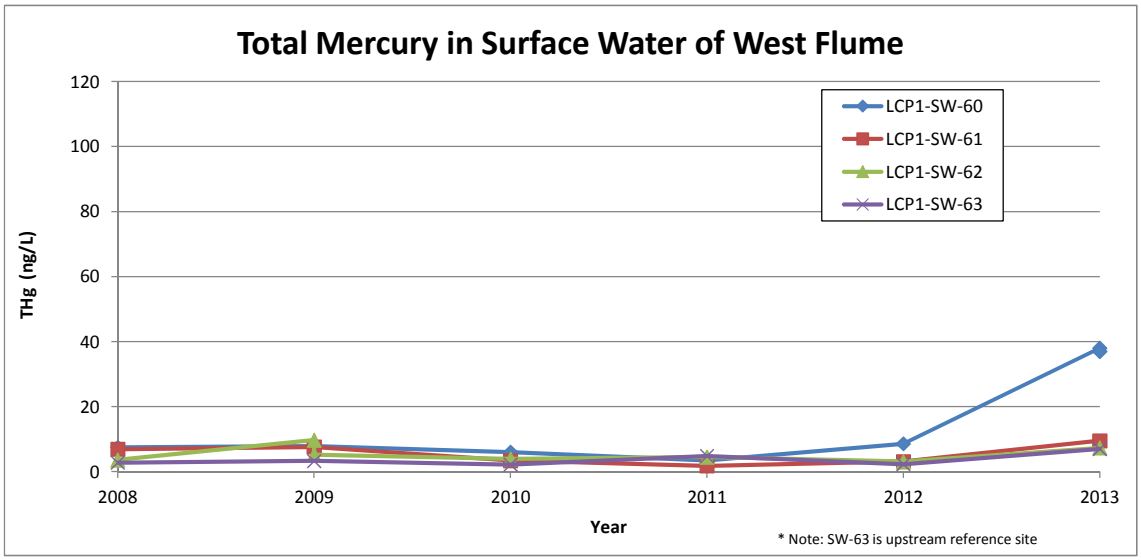
J: Result is considered an estimate.

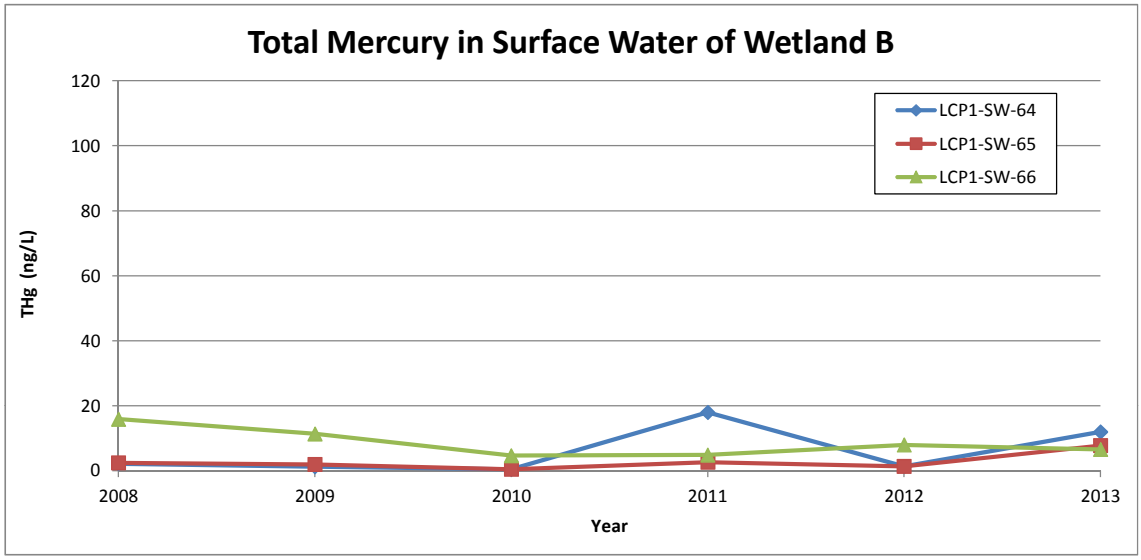
U: Not dectected.

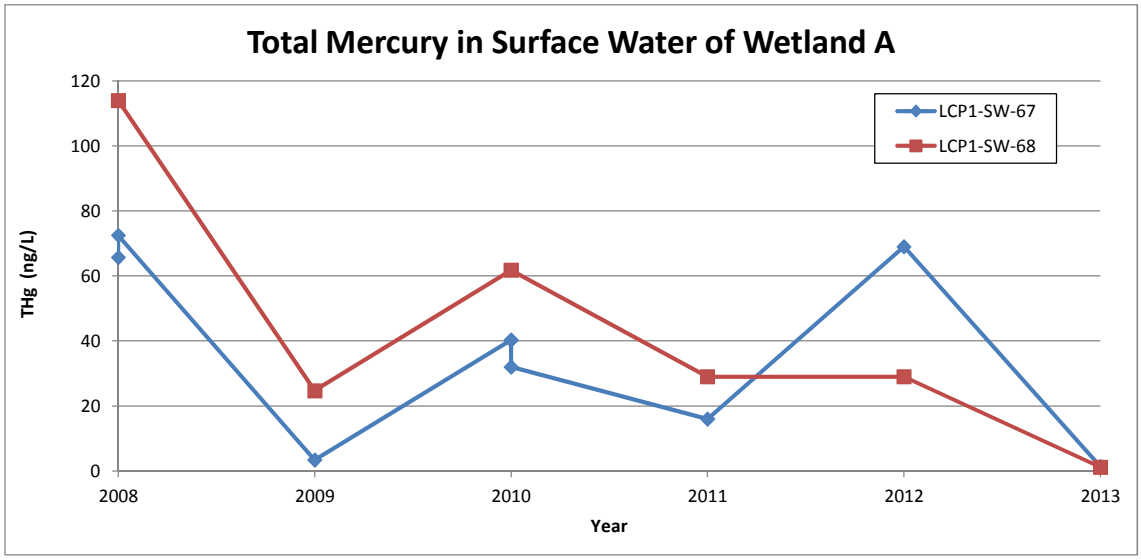
ND: Non-Detect, method dectection limit shown in paranthesis.

NA: Not analyzed

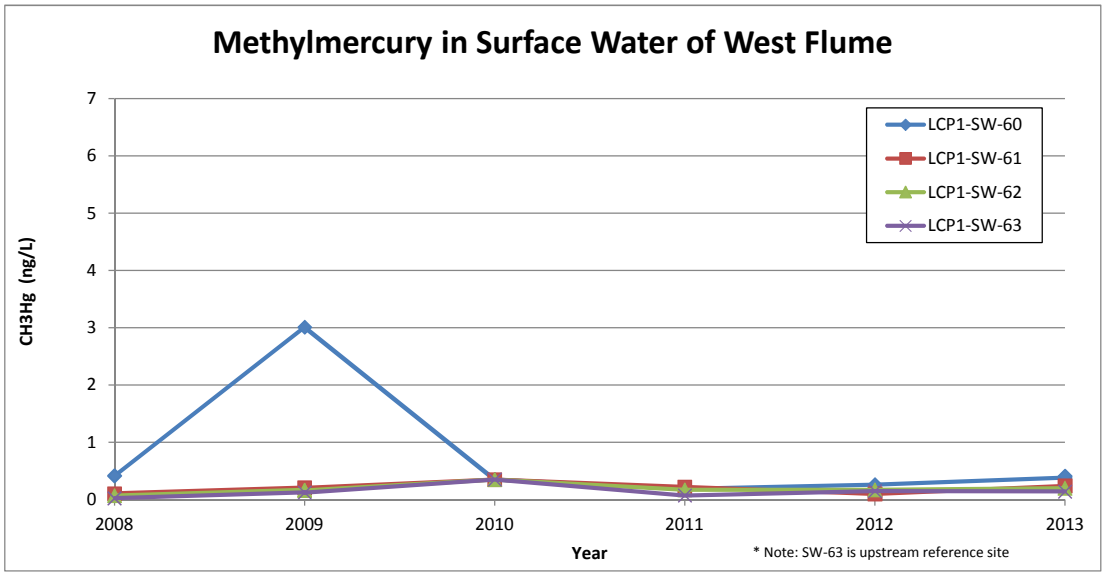
Total Mercury Trends in Surface Water
2008-2013

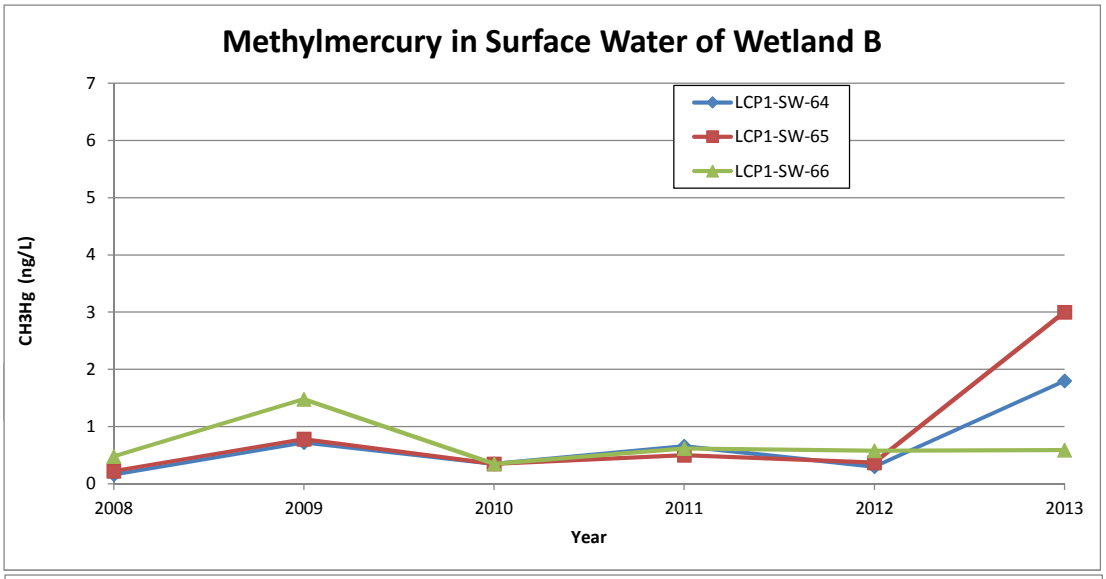


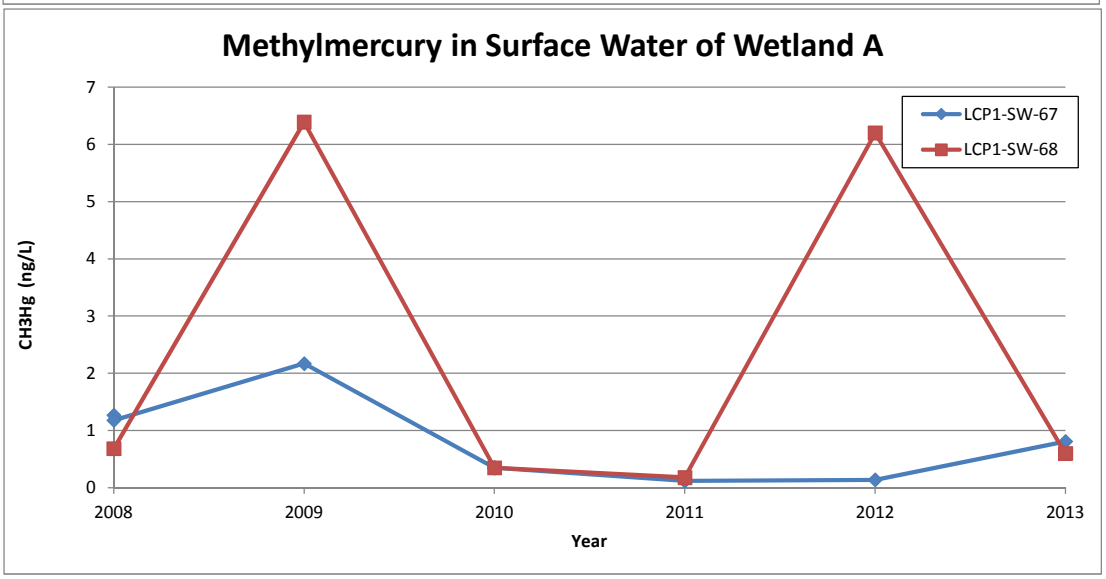




Methlymercury Trends in Surface Water
2008-2013





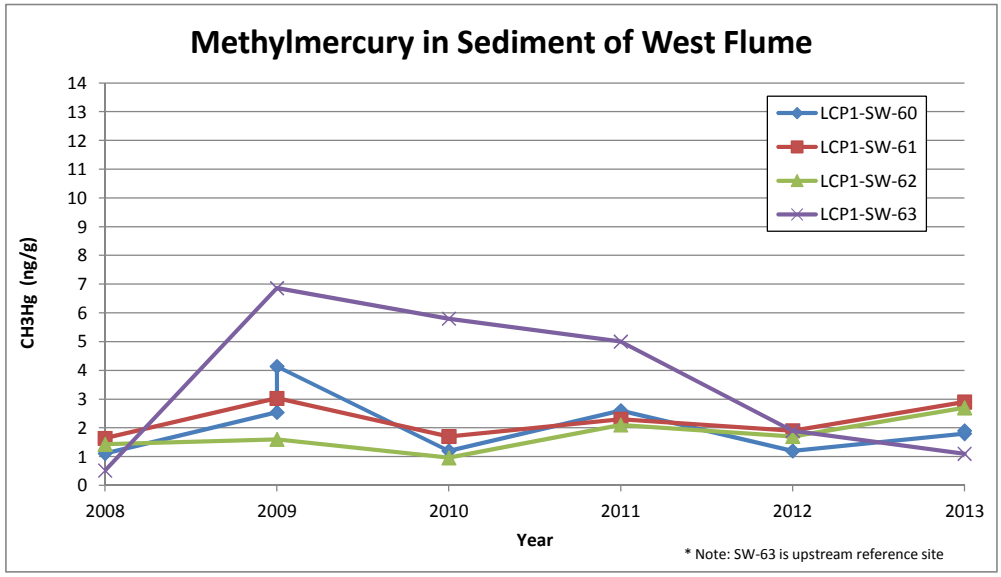


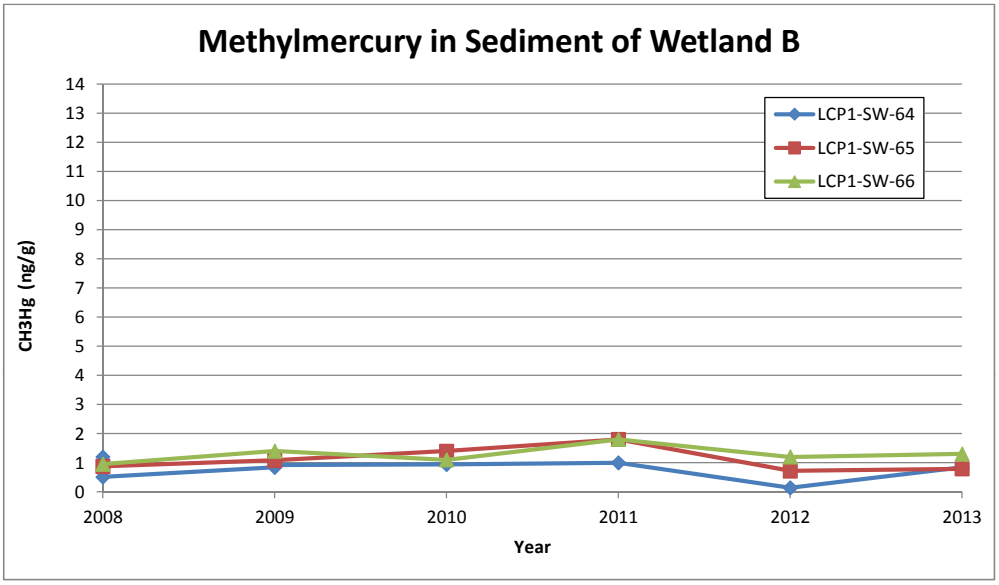
SEDIMENT ANALYTICAL RESULTS 2008 - 2012

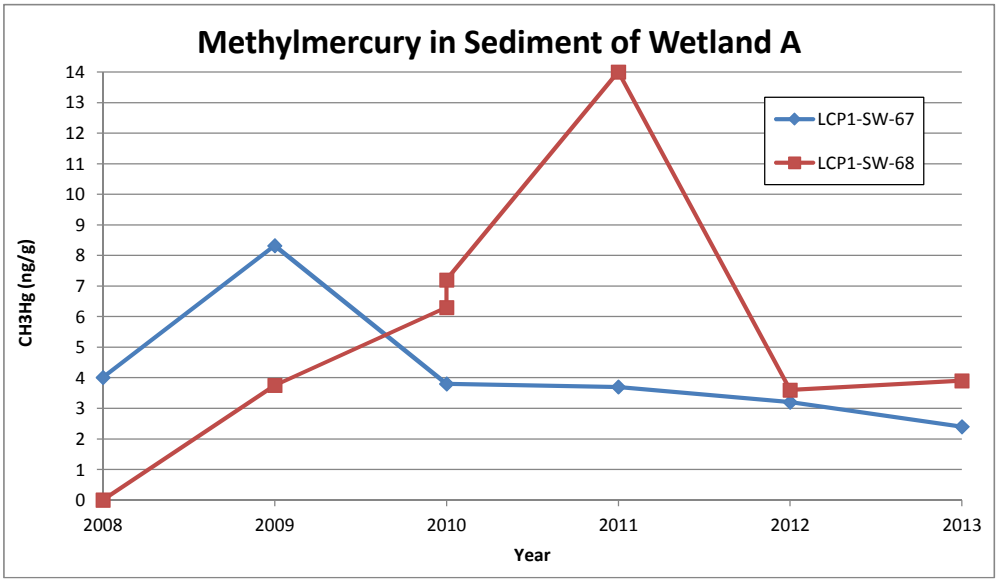
Location ID	December 2008				May 2009						October 2009				October 2010				August 2011				September 2012				August 2013			
	0 to 0.5 ft Mercury		0 to 0.5 ft Methyl Mercury		0 to 0.5 ft Mercury		0 to 0.2 ft Mercury		0.2 to 0.5 ft Mercury		0 to 0.5 ft Mercury		0 to 0.5 ft Methyl Mercury		Mercury		Methyl Mercury		Mercury		Methyl Mercury		Mercury		Methyl Mercury		Mercury		Methyl Mercury	
	mg/kg		ng/g		mg/kg		mg/kg		mg/kg		mg/kg		ng/g		mg/kg		ng/g		mg/kg		ng/g		mg/kg		ng/g		Result mg/kg	Qualifier	Result ng/g	Qualifier
West Plume																														
LCP1-SW-60	0.19	J	1.11		0.37	J	NA		NA		3.1/0.65	J	2.54/4.14		0.53	J	1.2	J	0.42		2.6		0.42	J	1.2		0.26/0.38	J	1.8/1.9	J
LCP1-SW-61	0.44	J	1.64		0.44	J	NA		NA		0.16		3.03		0.39		1.7	J	0.24		2.3		0.45	J	1.9		1.4	J	2.9	
LCP1-SW-62	0.16	J	1.43		0.27	J	NA		NA		0.31		1.6		0.21		0.96	J	0.3		2.1		0.36	J	1.7		0.12		2.7	
LCP1-SW-63	0.25	J	0.518		0.17	J	NA		NA		0.99		6.86		1.04		5.8	J	0.54		5		0.45	J	1.9		0.28		1.1	
Wetland B																														
LCP1-SW-64	0.48/0.81	J	1.2/.512		0.53	J	NA		NA		0.073		0.844/0.917		0.06		0.94	J	0.075	J	1		0.038	J	0.14	U	0.070		0.84	
LCP1-SW-65	0.057	J	0.876		0.078	J	NA		NA		0.84		1.08		0.6		1.4	J	0.68		1.8		0.13	J	0.72		0.13		0.79	
LCP1-SW-66	0.069	J	0.953		0.079	J	NA		NA		0.072		1.4		0.06		1.1	J	0.077	J	1.8		0.084	J	1.2		0.069		1.3	
Wetland A																														
LCP1-SW-67	0.32	J	4.01		4.2	J	NA		NA		0.96		8.32		0.33		3.8	J	0.24		3.7		0.29	J	3.2		0.65		2.4	
LCP1-SW-68	1.7	J	4.78		5.4/6.4		NA		NA		1.2		3.75		1.5/1.4		6.3/7.2	J	4.2		14		1	J	3.6		1.5		3.9	
LCP1-SED-69	NA		NA		NA		0.22/0.4	J	0.4	J	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Wetland A Additional Sampling																														
LCP1-SED-110															9.4															
LCP1-SED-111															1															
LCP1-SED-112															1.9															
LCP1-SED-113															0.14															
LCP1-SED-114															0.52															
LCP1-SED-115															0.09															

Table Notes:
J: Result is considered an estimate.
NA: Not analyzed

Methlymercury Trends in Sediment 2008-2013







BIOTA RESULTS
December 2008

Location	Mercury Result	Mercury Qualifier	Organism
	mg/kg		
West Flume Reach A	0.2		Creek Chub
West Flume Reach A	0.2		Creek Chub
West Flume Reach A	0.21		Creek Chub
West Flume Reach A	0.15		Brook Stickleback
West Flume Reach A	0.15		Brook Stickleback
West Flume Reach B	0.26		Creek Chub
West Flume Reach B	0.22		Creek Chub
West Flume Reach B	0.3		Brook Stickleback
West Flume Reach B	0.26		Brook Stickleback
West Flume Reach B	0.24		gpm
West Flume Reach C	0.43	J	Creek Chub
West Flume Reach C	0.18	J	Creek Chub
West Flume Reach C	0.52		Creek Chub
West Flume Reach C	0.4		Creek Chub
West Flume Reach C	0.27		Creek Chub
West Flume Reach C	0.32		Brook Stickleback
Wetland A	0.39	J	Earthworms
Wetland A	0.0091	J	White-footed Mouse
Wetland B	0.37	J	Earthworms
Wetland B	0.015	J	White-footed Mouse
Wetland B	0.0062	J	White-footed Mouse
Wetland B	0.018	J	White-footed Mouse
Wetland B	0.0057	J	White-footed Mouse

BIOTA RESULTS
October 2009

Location	Mercury Result	Mercury Qualifier	Organism
	mg/kg		
West Flume Reach A	0.071		Brook Sticklebacks
West Flume Reach A	0.1		Creek Chubs
West Flume Reach A	0.14		Creek Chubs
West Flume Reach A	0.22		Creek Chubs
West Flume Reach A	0.12		Creek Chubs
West Flume Reach A	0.037		Crayfish
West Flume Reach A	0.1		Crayfish
West Flume Reach B	0.13		Brook Sticklebacks
West Flume Reach B	0.077		Brook Sticklebacks
West Flume Reach B	0.41		Creek Chubs
West Flume Reach B	0.24		Creek Chubs
West Flume Reach B	0.21		Creek Chubs
West Flume Reach B	0.042		Crayfish
West Flume Reach B	0.055		Crayfish
West Flume Reach B	0.038		Crayfish
West Flume Reach B	0.089		Crayfish
West Flume Reach C	0.13		Brook Sticklebacks
West Flume Reach C	0.34		Creek Chubs
West Flume Reach C	0.39		Creek Chubs
West Flume Reach C	0.28		Creek Chubs
West Flume Reach C	0.2		Creek Chubs
West Flume Reach C	0.071		Crayfish
West Flume Reach C	0.096		Crayfish
West Flume Reach C	0.047		Crayfish
Wetland A	0.25		Dragonfly Nymphs
Wetland A	0.14		Dragonfly Nymphs
Wetland A	0.46		Earthworms
Wetland B	0.011	U	White-footed Mouse
Wetland B	0.011	U	White-footed Mouse
Wetland B	0.011	U	White-footed Mouse
Wetland B	0.011	U	White-footed Mouse
Wetland B	0.011	U	White-footed Mouse
Wetland B	0.21		Earthworms

BIOTA RESULTS
October 2010

Location	Mercury Result	Mercury Qualifier	Organism
	mg/kg		
West Flume Reach A	0.10		Brook Sticklebacks
West Flume Reach A	0.12		Creek Chubs
West Flume Reach A	0.19		Creek Chubs
West Flume Reach A	0.1		Creek Chubs
West Flume Reach A	0.1		Creek Chubs
West Flume Reach B	0.26		Creek Chubs
West Flume Reach B	0.29		Creek Chubs
West Flume Reach B	0.24		Creek Chubs
West Flume Reach B	0.22		Creek Chubs
West Flume Reach B	0.25		Creek Chubs
West Flume Reach C	0.24		Creek Chubs
West Flume Reach C	0.22		Creek Chubs
West Flume Reach C	0.23		Creek Chubs
West Flume Reach C	0.24		Creek Chubs
West Flume Reach C	0.26		Creek Chubs
Wetland A	0.29		Earthworms
Wetland B	0.06		Crayfish
Wetland B	0.09		Crayfish
Wetland B	0.48		Earthworms
Wetland A/B	0.02	B	Meadow Vole
Wetland A/B	0.01	B	Meadow Vole
Wetland A/B	0.03	U	Meadow Vole
Wetland A/B	0.34		Shorttail Shrew
Wetland A/B	0.02	B	Meadow Vole
Wetland A/B	0.02	B	Meadow Vole
Wetland A/B	0.03	U	Meadow Vole
Wetland A/B	0.01	B	White-footed Mouse
Wetland A/B	0.02	B	Meadow Vole
Wetland A/B	0.02	B	Meadow Vole
Wetland A/B	0.04		Meadow Vole
Wetland A/B	0.04		Deer Mouse
Wetland A/B	0.26		Shorttail Shrew

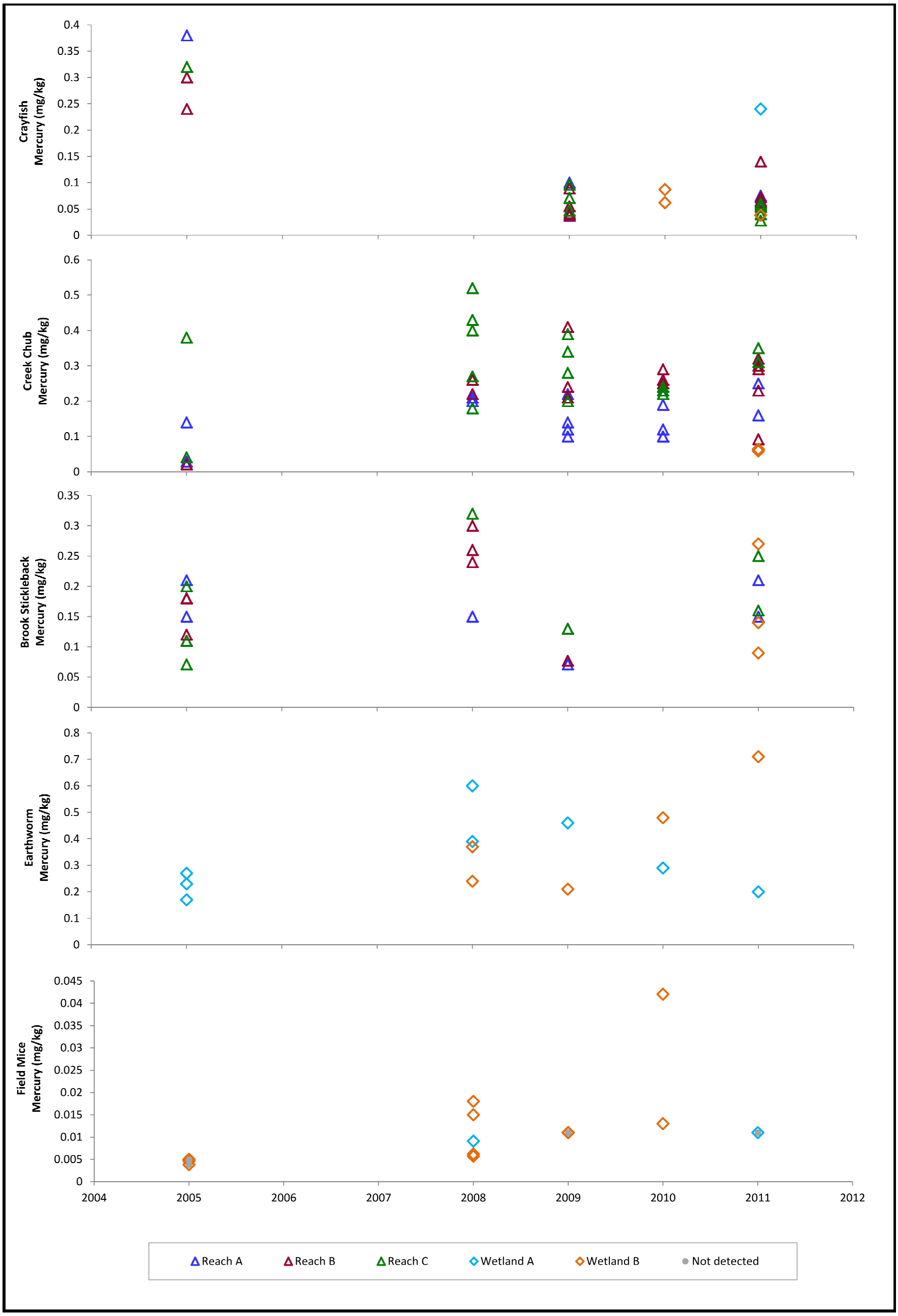
BIOTA RESULTS
August 2011

Location	Mercury Result	Mercury Qualifier	Methyl Mercury Result	Methyl Mercury Qualifier	Organism
	mg/kg		ug/kg		
West Flume Reach A	0.3	J			Creek chub
West Flume Reach A	0.25	J			Creek chub
West Flume Reach A	0.16	J			Creek chub
West Flume Reach A	0.15	J			Brook Stickleback
West Flume Reach A	0.21	J			Brook Stickleback
West Flume Reach A	0.054	J	53	J	Crayfish
West Flume Reach A	0.066	J	80	J	Crayfish
West Flume Reach A	0.075	J			Crayfish
West Flume Reach A	0.1	J			Dragonfly Nymphes
West Flume Reach B	0.32	J			Creek chub
West Flume Reach B	0.23	J			Creek chub
West Flume Reach B	0.3	J			Creek chub
West Flume Reach B	0.29	J			Creek chub
West Flume Reach B	0.092	J			Creek chub
West Flume Reach B	0.04	J	42	J	Crayfish
West Flume Reach B	0.064	J	73	J	Crayfish
West Flume Reach B	0.14	J			Crayfish
West Flume Reach B	0.072	J	71	J	Crayfish
West Flume Reach B	0.062	J	74	J	Crayfish
West Flume Reach C	0.31	J			Creek chub
West Flume Reach C	0.31	J			Creek chub
West Flume Reach C	0.35	J			Creek chub
West Flume Reach C	0.25	J			Brook Stickleback
West Flume Reach C	0.16	J			Brook Stickleback
West Flume Reach C	0.054	J	52	J	Crayfish
West Flume Reach C	0.06	J	52	J	Crayfish
West Flume Reach C	0.04	J	38	J	Crayfish
West Flume Reach C	0.057	J	91	J	Crayfish
West Flume Reach C	0.028	J	42	J	Crayfish
Wetland A	0.22	J			Dragonfly Nymphes
Wetland A	0.24	J			Crayfish
Wetland B	0.06	J			Creek chub
Wetland B	0.06	J			Creek chub
Wetland B	0.09	J			Brook Stickleback
Wetland B	0.27	J			Brook Stickleback
Wetland B	0.14	J			Brook Stickleback
Wetland B	0.075	J	78	J	Dragonfly Nymphes
Wetland B	0.038	J	49	J	Crayfish
Wetland A/B	0.2	J			Earthworms
Wetland A/B	0.71	J			Earthworms
Wetland A/B	0.01	UJ			Deer Mouse
Wetland A/B	0.01	UJ			Meadow Vole
Wetland A/B	0.09	J			Shrew
Wetland A/B	0.11	J			Shrew
Wetland A/B	0.01	UJ			Meadow Vole

BIOTA RESULTS
August 2012

Location	Mercury Result	Mercury Qualifier	Methyl Mercury Result	Methyl Mercury Qualifier	Organism
	mg/kg		ug/kg		
West Flume Reach A	0.23				Creek Chubs
West Flume Reach A	0.21				Creek Chubs
West Flume Reach A	0.17				Creek Chubs
West Flume Reach A	0.086				Brook Stickleback
West Flume Reach A	0.19				Brook Stickleback
West Flume Reach A	0.023	J	19	J	Crayfish
West Flume Reach A	0.073		56	J	Crayfish
West Flume Reach A	0.1		80	J	Crayfish
West Flume Reach A	0.036		43	J	Crayfish
West Flume Reach A	0.032		27	J	Crayfish
West Flume Reach B	0.29				Creek Chubs
West Flume Reach B	0.33				Creek Chubs
West Flume Reach B	0.21				Creek Chubs
West Flume Reach B	0.21				Creek Chubs
West Flume Reach B					
West Flume Reach B	0.065		79	J	Crayfish
West Flume Reach B	0.026	J	24	J	Crayfish
West Flume Reach B	0.054		40	J	Crayfish
West Flume Reach B	0.025	J	21	J	Crayfish
West Flume Reach B	0.051		52	J	Crayfish
West Flume Reach C	0.14				Creek Chubs
West Flume Reach C	0.13				Creek Chubs
West Flume Reach C	0.12				Creek Chubs
West Flume Reach C	0.15				Creek Chubs
West Flume Reach C	0.11				Creek Chubs
West Flume Reach C	0.01	UJ	8.8	J	Crayfish
West Flume Reach C	0.026	J	24	J	Crayfish
West Flume Reach C	0.029	J	29	J	Crayfish
West Flume Reach C	0.019	J	14	J	Crayfish
West Flume Reach C	0.019	J	25	J	Crayfish
Wetland A	0.14		130	J	Dragonfly Nymphes
Wetland A	0.15		42	J	Crayfish
Wetland A	0.1	J	120	J	Crayfish
Wetland A	0.073	J	67	J	Crayfish
Wetland A	0.48				Earthworms
Wetland B	0.033		38	J	Dragonfly Nymphes
Wetland B	0.06		51	J	Dragonfly Nymphes
Wetland B	0.069				Creek Chubs
Wetland B	0.038				Creek Chubs
Wetland B	0.047				Creek Chubs
Wetland B	0.047				Creek Chubs
Wetland B	0.041				Creek Chubs
Wetland B	0.32	J	29	J	Crayfish
Wetland B	0.018	J	25	J	Crayfish
Wetland B	0.029	J	35	J	Crayfish
Wetland B	0.3				Earthworms
Wetland A/B	0.01	U			White Footed Mouse
Wetland A/B	0.011	U			Meadow Vole
Wetland A/B	0.24				Shorttail Shrew
Wetland A/B	0.01	U			White Footed Mouse

Table Notes:
U: Not detected
J: Result is considered an estimate.
UJ: Result is estimated not detected
B: Anaylyte detected in the laboratory/method blank as well as in the sample.



Honeywell

FORMER LINDEN CHEMICAL PLANT
SOLVAY, NEW YORK

MERCURY CONCENTRATIONS IN TISSUE BIOTA SAMPLES

PARSONS

301 PLAINFIELD ROAD, SUITE 350, SYRACUSE, N.Y. 13212, PHONE: 315-451-9560

FILE NAME: P:\HONEYWELL -SYR\447459 LCP - OU 1 2012\10.0 -TECHNICAL\CAD\FIGURES\447459-SK001.DWG
PLOT DATE: 6/19/2014 8:55 AM PLOTTED BY: RUSSO, JILL

APPENDIX B

WETLANDS MONITORING REPORT YEAR 5 - 2012

WETLAND MONITORING REPORT – YEAR 5 (2012)
LCP BRIDGE STREET SITE

TOWN OF GEDDES
ONONDAGA COUNTY, NEW YORK

Prepared for:

PARSONS
301 Plainfield Road, Suite 350
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Prepared by:

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Phoenix, New York 13135

November 2012

TABLE OF CONTENTS

Page

1.0 INTRODUCTION 1

2.0 WETLAND REMEDIATION/RESTORATION EFFORTS 1

3.0 MONITORING METHODS 2
- **3.1 Vegetation** 2
- **3.2 Hydrology** 2
- **3.3 Wildlife** 3

4.0 MONITORING RESULTS 3
- **4.1 Introduction** 3
- **4.2 Vegetation** 3
  - **Wetland A** 3
  - **Wetland B** 3
  - **West Flume** 4
- **4.3 Hydrology** 5
- **4.4 Wildlife** 5
  - **Fish** 5
  - **Macroinvertebrates** 5
  - **Amphibians/Reptiles** 6
  - **Birds** 6
  - **Mammals** 6

5.0 WETLAND RESTORATION SUCCESS AND MAINTENANCE 6
- **5.1 Invasive Species Control** 7

6.0 SUMMARY 7

7.0 REFERENCES 9

APPENDIX A – Monitoring Data Sheets
APPENDIX B – Representative Photographs

LIST OF TABLES

(all tables follow text)

Table 1. Plantings at the LCP Bridge Street Restoration Area

Table 2. Seeding and Mulching at the LCP Bridge Street Restoration Area

Table 3. Supplemental Tree and Shrub Plantings on May 19, 2008

Table 4. Plant Species Observed in 2012, LCP Bridge Street Restoration Area

Table 5. Vegetation Data Summary, Wetland A, Emergent Cover Type, LCP Bridge Street Restoration Area (2012)

Table 6. Vegetation Data Summary, Wetland B, Emergent Cover Type, LCP Bridge Street Restoration Area (2012)

Table 7. Vegetation Data Summary, Wetland B, Aquatic Bed Cover Type, LCP Bridge Street Restoration Area (2012)

Table 8. Vegetation Data Summary, West Flume, Emergent Wetland Cover Type, LCP Bridge Street Restoration Area (2012)

Table 9. Staff Gauge Readings, 2012, LCP Bridge Street Restoration Area

Table 10. Wildlife Observations, 2012, LCP Bridge Street Restoration Area

Table 11. Mammals, Fish, Amphibians, and Macroinvertebrates Collected during 2012 Bioassessment Surveys, LCP Wetland Restoration Area

LIST OF FIGURES

(all figures follow tables)

Figure 1. Site Location, LCP Bridge Street Restoration Area

Figure 2. NYS Freshwater Wetlands Map, LCP Bridge Street Restoration Area

Figure 3. April 2006 Aerial Photograph Showing Remediation Work (in progress), LCP Bridge Street Restoration Area

Figure 3a. April 2009 Aerial Photograph Showing Remediation Work (completed), LCP Bridge Street Restoration Area

Figure 3b. November 2008 Oblique Aerial Photograph, LCP Bridge Street Restoration Area

Figure 4. Post Remediation Grading Plan, LCP Bridge Street Restoration Area

Figure 5. Post Remediation Grading Plan with Locations of Staff Gauges, Sampling Plots, and Photograph Points, LCP Bridge Street Restoration Area

Figure 5a. Post Remediation Grading Plan with Sampling Plots and Photograph Locations, LCP Bridge Street Restoration Area

Figure 6. Vegetation Cover Types, Year 5 (2012) of Monitoring, LCP Bridge Street Restoration Area

Figure 7. Invasive Species Areas, Year 5 (2012) of Monitoring, LCP Bridge Street Restoration Area

1.0 INTRODUCTION

Terrestrial Environmental Specialists, Inc. (TES) worked with Parsons and the New York State Department of Environmental Conservation (NYSDEC) to develop a wetland restoration plan to restore wetlands and the West Flume following remediation work at the LCP Bridge Street site. The wetland restoration site is located in the Town of Geddes, Onondaga County, New York (Figure 1).

Remediation work involved the excavation of wetlands in portions of NYSDEC freshwater wetland SYW-14 (Figure 2) and an adjacent drainage feature called the West Flume (Figures 1 and 2). An April 2006 aerial photograph (Figure 3) shows the areas while remediation was underway. An April 2009 aerial photograph (Figure 3a) and a November 2008 oblique aerial photograph (Figure 3b) show the areas after completion of the remediation. The wetland restoration area occurred south of a gravel road that parallels the West Flume. The West Flume drains to the northwest into Geddes Brook, which flows under railroad tracks before discharging into Ninemile Creek, a tributary to Onondaga Lake.

In 2011, additional remediation occurred in the West Ditch and the upper (eastern) portion of Wetland A. Excavation occurred in these areas in September 2011.

The wetland areas and the West Flume were restored under a restoration plan approved by the review agencies. The plan is briefly described in Section 2.0 of *Wetland Monitoring Report – Year 1 (2008) LCP Bridge Street Site* (TES 2009).

Wetland monitoring was part of the restoration plan, with monitoring required for a minimum of five years specified in the *Operation, Maintenance, and Monitoring Plan for the LCP Bridge Street Site, Solvay, New York* (Parsons 2008). Methods and results for Year 5 (2012) of wetland monitoring are provided in Sections 3.0 and 4.0, respectively, of the following report. Maintenance procedures implemented in the wetland restoration area during the year are provided in Section 5.0.

2.0 WETLAND REMEDIATION/RESTORATION EFFORTS

Remediation at the LCP Bridge Street site required the excavation of portions of NYSDEC wetland SYW-14 and the adjacent West Flume. The remediation design was presented in the *Final (100%) Design Report for the LCP Bridge Street (OU-1) Site* (Parsons 2004). Details about the wetland restoration and reclamation plans can be found in the *Wetland Monitoring Report – Year 1 (2008) LCP Bridge Street Site* (TES 2009). Additional remediation occurred in the West Ditch and the eastern portion of Wetland A in 2011.

Native plant species were selected for the vegetation restoration efforts. Species, quantities, and types of stock planted in the wetland restoration area, West Flume, and adjacent uplands are presented in Table 1. Seeding and mulching details are provided in Table 2. Some supplemental tree and shrub plantings were performed in 2008. These are detailed in Section 5.0 of the Year 1 report (TES 2009), and are also listed in Table 3.

3.0 MONITORING METHODS

Methods proposed to monitor the restored wetland areas and West Flume are provided in Parsons (2008). The proposed parameters to be monitored included: vegetation, hydrology, wildlife usage, and invasive species.

3.1 Vegetation

Vegetation monitoring included field reconnaissance surveys, qualitative assessments, and quantitative sampling. Field reconnaissance surveys occurred at several times from May to October, 2012. More detailed qualitative assessments were performed in July and August, 2012. Quantitative sampling of vegetation occurred in August 2012.

Vegetation sampling was conducted on August 28, 2012 to assess the vegetation in Wetland A, Wetland B, and the West Flume. The vegetation data were collected from 18 permanent circular sample plots. The plots were located in each of the three restored areas and in the different vegetation cover types present in each area; plot locations are shown on Figures 5 and 5a.

Each permanent sample plot was 10 feet in diameter. Wooden stakes were installed to mark the center of each plot, which was also located using GPS equipment. To establish the 10-foot diameter, a cloth tape measure was attached to the stake, extended to 5 feet and walked around the stake.

Vegetation data collected in each sample plot consisted of the following: 1) the vegetation cover type present, 2) total percent areal cover of vegetation, 3) plant species observed, and 4) the percent areal cover of each species. Sample plot data sheets used are presented in Appendix A.

Photographs were taken at various times during the 2012 monitoring. At the time of the quantitative sampling, photographs were taken at each plot and at permanent photograph points shown on Figure 5. The location and direction of the photographs are shown on Figure 5a (Sheets 1 and 2), and the photographs are presented in Appendix B.

3.2 Hydrology

The hydrology conditions in the restoration areas were monitored during the growing season using staff gauges. The gauges were installed in Wetland A and Wetland B on June 11, 2008. Staff gauge locations are shown on Figure 5 (Sheets 1 and 2).

Water level monitoring occurred ten times from June through October 2012. Water depths were also recorded at the center of each vegetation sample plot during the quantitative vegetation sampling that occurred on August 28, 2012.

3.3 Wildlife

During field reconnaissance visits to the restoration areas, records were kept of all wildlife species seen in or in the vicinity of the area. Specific efforts occurred during the breeding season for birds and amphibians in 2012.

4.0 MONITORING RESULTS

4.1 Introduction

The restoration area is composed of three areas: Wetland A, Wetland B, and the West Flume. An April 2009 aerial photograph (Figure 3a) and a November 2008 oblique aerial photograph (Figure 3b) show the three areas after restoration. The post-remediation grading plan for these three areas is provided as Figure 4. Figure 6 shows the location and extent of the vegetation cover types found in the restoration areas during the 2012 monitoring effort. Plant species observed in the areas are listed in Table 4. The vegetation, hydrology, and wildlife usage of the restored areas is described in the following sections.

4.2 Vegetation

A total of 155 plant species were recorded in and around Wetlands A and B and the West Flume in 2012 (Table 4). This is an increase of 7 species from the 2011 sampling and an increase of 40 species from the 2010 sampling.

Wetland A

Plant species observed in Wetland A are presented in Table 4. Vegetation plot data for Wetland A are provided in Appendix A, with a summary of the data presented in Table 5.

Wetland A contained primarily an emergent wetland cover type during the August 2012 quantitative vegetation monitoring, with a small area of aquatic bed in the recently remediated area (Figure 6). Three sampling plots were located in Wetland A, all occurring in emergent wetland (Figure 5).

The dominant plant species in Wetland A were broad-leaf cattail (*Typha latifolia*) and common reed (*Phragmites australis*). These two species account for approximately 88 percent (%) of the total vegetation cover (Table 5). Broad-leaf cattail has a wetland indicator status of obligate (OBL) and common reed has an indicator status of facultative-wet (FACW). Broad-leaf cattail continues to be the dominant plant in Wetland A, and this is consistent with what was found by the 2010 and 2011 monitoring efforts. Common reed cover has continued to increase.

Wetland B

Plant species observed in Wetland B are listed in Table 4. Vegetation plot data are presented in Appendix A, with summaries of the data presented in Tables 6 and 7.

Wetland B contained two vegetation cover types during the August 2012 quantitative vegetation monitoring (Figure 6). The two cover types were emergent wetland and aquatic bed. The area of emergent wetland was reduced somewhat from prior years. A total of twelve sampling plots were located in Wetland B, with seven in the emergent wetland area and five in the aquatic bed area.

The emergent wetland portions of Wetland B were dominated by white cattail *(Typha x glauca*) and broad-leaf cattail. These two dominants were also closely associated with narrow-leaf cattail (*Typha angustifolia*) and common reed. These four species account for approximately 75% of the total plant vegetation cover in the emergent wetland areas of Wetland B (Table 6). The above mentioned species have a wetland indicator status of OBL with the exception of common reed, which is FACW. As in 2011, the 2012 sampling data show broad-leaf cattail as a dominant plant.

The aquatic bed portion of Wetland B contained three dominant plant species: coontail (*Ceratophyllum demersum*), white water lily (*Nymphaea odorata*), and star duckweed *(Lemna trisulca*). The three dominant plant species account for approximately 75% of the total cover in the Wetland B aquatic bed area (Table 7). All of the plant species have a wetland indicator status of OBL. Dominant plants in the aquatic bed of Wetland B in 2012 were the same as 2011, with the exception of broad-leaf cattail. The relative cover of broad-leaf cattail has decreased by 6% since 2011.

West Flume

Plant species observed in the West Flume in 2012 are presented in Table 4. Vegetation plot data for the West Flume are provided in Appendix A, with a summary of the data presented in Table 8.

The West Flume contained one vegetation cover type (emergent wetland) during the August 2012 vegetation monitoring. Three sampling plots were located in the West Flume.

Common reed, white cattail, and broad-leaf cattail were the dominant plants in the West Flume in 2012 (Table 8). These species, which all have an indicator status of facultative wet or wetter, account for approximately 83% of the total cover. The relative cover of common reed and broad-leaf cattail increased from 2011 to 2012, while the relative cover of white cattail decreased.

An interesting plant species was found growing in the West Flume during the 2008 monitoring effort. The plant found is seaside bulrush (*Scirpus maritimus* spp. *paludosus*, currently *Schoenoplectus maritimus*). The species continued to persist in the upper portions of the West Flume through 2011. Although it was not documented in 2012, it is likely still present. Seaside bulrush is a state-listed endangered plant. It is listed as endangered in New York under the Protected Plant Act (Section 9-1503 of the Environmental Conservation Law). It has a limited distribution in upstate New York; it is confirmed extant in Cayuga and Onondaga Counties and also occurs in Nassau and Suffolk Counties (Young 2008).

Seaside bulrush was historically known from several locations in the Onondaga Lake area, including areas near the State Fair Grounds. These historical sightings are summarized in McMullen (1993). Recent records of the species are from near the Onondaga Lake Parkway in the southeastern portion of the lake.

4.3 Hydrology

Water levels in Wetland A were monitored nine times and levels in Wetland B were monitored ten times in 2012 (Table 9). Based on the water elevation data collected in 2012 water levels continually decreased from June through September.

In Wetland A, the water surface elevation fluctuated between less than 378.84 feet to 380.25 feet (Table 9). The lowest water elevations were observed during August and September when there was no water recorded at the staff gauge location. The highest water elevation was recorded on October 11, 2012.

In Wetland B, the water surface elevation fluctuated between 374.68 feet to 376.02 feet (Table 9). The lowest water elevations were observed in September. The highest water elevation was observed on June 8, 2012.

There was a near record drought during the summer of 2012. This is the first year since the monitoring was initiated in 2008 that water levels in the wetlands did not remain near the design water level elevation during the growing season. Wetlands throughout central New York were affected by the drought conditions.

4.4 Wildlife

Wildlife observations from the restoration areas are presented in Table 10. These observations were made at various times during the 2012 season. Mammals, fish, amphibians, and macroinvertebrates collected during the 2012 bioassessment surveys are presented in Table 11. One amphibian, a northern green frog tadpole (*Lithobates clamitans melanota*) was captured during the bioassessment surveys (Table 11).

Fish

Fish were noted in the West Flume and Wetland B during the 2012 monitoring. TES did not sample for fish, but fish collected during the biota assessment were identified by TES and are presented in Table 11. Fish species collected in the West Flume included brook stickleback (*Culaea inconstans*) and creek chub (*Semotilus atromaculatus*). Creek chub was the most abundant species. Only creek chub was observed in Wetland B in 2012.

Macroinvertebrates

Macroinvertebrates were sampled in the West Flume and Wetlands A and B during the 2012 bioassessment monitoring. Three groups of macroinvertebrates were collected, including crayfish, dragonflies/damselflies, and earthworms (Table 11).

Amphibians/Reptiles

One toad and three species of frogs were noted in the restoration area and vicinity during 2012 (Table 10). Eastern American toad (*Anaxyrus americanus*) was found in Wetland A. American bullfrog (*Lithobates catesbeianus*) was found in Wetland B. Northern green frog (*Lithobates clamitans melanota*) and northern leopard frog (*Lithobates pipiens*) were found in Wetland A, Wetland B, and the West Flume. The observation of bullfrog is of note because it is not currently known from Onondaga Lake or the adjacent wetlands.

Eastern snapping turtle (*Chelydra s. serpentina*) and painted turtle (*Chrysemys picta*) were observed in Wetland B during the 2012 monitoring effort. These observations are important because they further indicate the restored wetland's suitability and success in supporting wildlife.

Birds

Table 10 lists the bird species seen or heard in the vicinity of the restoration areas. Species observed included several wetland species, such as Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), wood duck (*Aix sponsa*), American coot (*Fulica americana*), pied-billed grebe (*Podilymbus podiceps*), green heron (*Butorides virescens*), willow flycatcher (*Empidonax traillii*), and red-winged blackbird (*Agelaius quiscula*). Red-winged blackbird is a common nesting species in the restored wetland areas. Pied-billed grebe is listed as a threatened species by the NYSDEC. This species was observed in Wetland B. This is the third year that pied-billed grebe has successfully nested in Wetland B. Another interesting bird record in 2012 was an observation of a brood of wood ducks in Wetland B, an indication that this species nested in the trees adjacent to the wetland.

Mammals

White-tailed deer (*Odocoileus virginianus*) sign was observed in the vicinity of Wetland A. Muskrat (*Ondatra zibeticus*) sign was observed in Wetland A, Wetland B, and the West Flume. In Wetland B an American beaver (*Castor canadensis*) and its sign were observed, which is the first record of it in this wetland. During the bioassessment work, several species of small mammal were collected. These included: short-tailed shrew (*Blarina brevicauda*), white-footed mouse (*Peromyscus leucopus)*, and meadow vole (*Microtus pennsylvanicus*).

5.0 WETLAND RESTORATION SUCCESS AND MAINTENANCE

Restoration of the LCP remediation areas, including Wetland A, Wetland B, and the West Flume, has been tremendously successful. Areas that were previously dominated by a monoculture of the invasive common reed with little aquatic habitat component, are now diverse wetlands, supporting a mix of plant and animal species and containing an interspersion of aquatic habitat. The improvement in habitat value of these areas is significant. As previously noted, the nesting of a state-listed bird is also an indication of restoration success.

While the restoration of the LCP remediation areas is considered very successful based on the five years of monitoring, maintenance of the areas is considered necessary to maintain the habitat value. The two concerns are: 1) the encroachment of common reed into the areas, and 2) the success of the plantings, particularly woody species.

5.1 Invasive Species Control

Common reed occurs in various locations within and around the edges of Wetlands A and B, and the West Flume. Most of the common reed is in upland areas or in wetland fringes but it has increased significantly from 2011 to 2012 in portions of Wetland A and especially in the West Flume. The more abundant areas are shown on Figure 7. Additional remediation work occurred in 2011 in the eastern portion of Wetland A, where common reed occurred previously.

Measures were implemented in 2012 to control common reed grass. These measures included the application of the herbicide Rodeo® (glyphosate) and Clearcast to many of the areas where common reed grass was abundant. The herbicide did not occur until very late in the season (October 9 and 10), which did not allow for a complete treatment or an assessment of the effectiveness of the treatment. Additional treatment is planned for 2013 after the monitoring of the areas.

6.0 SUMMARY

Remediation efforts at the LCP Bridge Street site were focused on wetland areas and a drainage feature called the West Flume. The wetland areas (Wetland A and Wetland B) are part of NYSDEC Wetland SYW-14.

Detailed plans were developed by Parsons, TES, and NYSDEC to restore these areas. These plans are presented in Parsons (2004).

The wetlands and the West Flume were originally dominated by a monoculture of the invasive grass common reed and had limited aquatic habitat. Design for the restoration targeted a wetter wetland system to diversify the habitats, provide areas unsuitable for common reed, and increase the aquatic habitat component. Shrub and tree plantings were provided around the restored areas. Remediation efforts occurred from 2005 to 2007. Some additional remediation occurred in the West Ditch and the eastern portion of Wetland A in 2011. Initial restoration of the wetlands and West Flume occurred in the latter portion of this time period, with extensive vegetation planting in the fall of 2007.

Monitoring of the restored areas was required and is described in the Operation, Maintenance and Monitoring Plan (Parsons 2008). Monitoring occurred in 2008, 2009, 2010, 2011, and 2012. Results of the fifth year of monitoring (2012) are presented in the current report.

Vegetation, hydrology, and wildlife usage were monitored during 2012 in the restored wetlands and the West Flume. A vegetation cover map of the restored areas is provided. Vegetation in the restored wetlands and West Flume was primarily persistent emergent and

aquatic bed. A total of 155 plant species were observed in the area, most of which were wetland species. Seaside bulrush, a state-listed endangered plant which was noted in the West Flume since 2008, was not found this year, although it likely occurs there.

Hydrology was monitored in Wetlands A and B from June through October 2012 using staff gauges. With the near record drought conditions in 2012, water levels continually decreased from June through September. This is the first year that water levels were not maintained near design elevations.

Wildlife usage of the restored wetlands and the West Flume was extensive. Species of fish were observed in Wetland B and the West Flume in 2012. Leopard frogs were particularly abundant in the restored wetlands, with toads, bullfrogs, and green frogs being noted as well. Snapping turtles and painted turtles were observed in Wetland B in 2012. Numerous wetland birds were observed in the area during the year, including the state-listed threatened pied-billed grebe, which has successfully nested for the third year in Wetland B. A few mammals were noted, and muskrat usage continues; many additional species likely utilize the area.

Overall, the restored areas were found to be very successful during the five years of monitoring. Common reed still occurs in several locations in uplands around the restored areas and has increased in percent cover in certain areas, especially the West Flume. Herbicide treatment or cuttings to control common reed occurred in 2008 and 2009. Mowing and hand cutting to control common reed occurred in 2010. Control measures of herbicide application were implemented late in the growing season in 2012. Additional treatment is planned for 2013.

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TABLES

Table 1.

Plantings at the LCP Bridge Street Restoration Area

WETLAND PLANTING ZONE A2 (edge of water to 2 feet above water)		
Quantity	**Scientific Name[a]**	**Common Name**
118	*Populus deltoides*	Eastern cottonwood
118	*Fraxinus pennsylvanica*	Green ash
30	*Populus tremuloides*	Trembling aspen
88	*Quercus bicolor*	Swamp white oak
59	*Sambucus canadensis*	Elderberry
59	*Salix amygdaloides*	Peach-leaf willow
118	*Salix discolor*	Pussy willow
118	*Cornus amomum*	Silky dogwood
WETLAND PLANTING ZONE B1 (water 0 to 1 foot deep)		
348	*Sagittaria latifolia*	Arrowhead
348	*Sparganium americanum*	Burreed
348	*Scirpus tabernaemontani*	Soft-stem bulrush
348	*Leersia oryzoides*	Rice cutgrass
348	*Juncus effusus*	Soft rush
348	*Eleocharis obtusa*	Creeping spikerush
348	*Carex vulpinoidea*	Fox sedge
348	*Scirpus cyperinus*	Woolgrass
348	*Polygonum hydropiperoides*	Swamp smartweed
WETLAND PLANTING SUB-ZONE B2 (water 1 to 2 feet deep)		
3432	*Alisma subcordatum*	Water plantain
500	*Pontederia cordata*	Pickerel weed
280	*Pontederia cordata*	Pickerel weed
624	*Utricularia vulgaris*	Bladderwort
WETLAND PLANTING ZONE C AQUATIC BED (water 2 to 4 feet deep)		
1155	*Elodea canadensis*	Water weed
924	*Coleogeton pectinatum*	Sago pondweed
231	*Nymphaea odorata*	Water lily
231	*Nuphar lutea*	Yellow water lily
WEST FLUME AREA (side slopes to flume)		
90	*Populus deltoides*	Eastern cottonwood
90	*Fraxinus pennsylvanica*	Green ash
30	*Populus tremuloides*	Trembling aspen
60	*Quercus bicolor*	Swamp white oak
45	*Sambucus canadensis*	Elderberry
45	*Salix amygdaloides*	Peach-leaf willow
90	*Salix discolor*	Pussy willow
90	*Cornus amomum*	Silky dogwood

[a] Nomenclature follows Mitchell and Tucker (1997).

Table 2.

Seeding and Mulching at the LCP Bridge Street Restoration Area

WETLAND SEED MIX[b]	
Scientific Name[a]	**Common Name**
Agrostis alba	Redtop
Carex comosa	Cosmos sedge
Carex vulpinoidea	Fox sedge
Carex scoparia	Blunt broomsedge
Scirpus atrovirens	Green bulrush
Typha latifolia	Broad-leaf cattail
Bidens cernua	Beggars-tick
Glyceria striata	Fowl mannagrass
Polygonum pensylvanicum	Pennsylvania smartweed
Polygonum hydropiperoides	Marsh smartweed
Eleocharis obtusa	Spikerush
Juncus effusus	Soft rush
Sparganium americanum	Eastern burreed
Verbena hastata	Blue vervain
Leersia oryzoides	Rice cutgrass

CONSERVATION SEED MIX[c]		
Scientific Name[a]	**Common Name**	**Lbs./Acre**
Trifolium repens	White clover, Dutch	2.5
Agrostis perennans	Autumn bentgrass, PA Ecotype	5
Lolium perenne	Perennial ryegrass, “Saint” (turf type)	10
Phleum pratense	Timothy	10
Dactylis glomerata	Orchard grass, “Potomac”	10
Bromus inermis	Smooth brome	10
Agrostis scabra	Ticklegrass (rough bentgrass), PA Ecotype	4
	Total	51.5

[a] Nomenclature follows Mitchell and Tucker (1997).
[b] Seeding rate – 15 bulk lbs./acre.
[c] Seeding rate – 51.51 lbs./acre.

Table 3.

Supplemental Tree and Shrub Plantings on May 19, 2008

Quantity	Scientific Name[(a)]	Common Name
9	*Populus deltoides*	Eastern cottonwood
9	*Fraxinus pennsylvanica*	Green ash
10	*Salix purpurea*	Streamco willow
10	*Salix discolor*	Pussy willow
10	*Cornus amomum*	Silky dogwood

[(a)] Nomenclature follows Mitchell and Tucker (1997).

Table 4.

Plant Species Observed in 2012, LCP Bridge Street Restoration Area

TREES

Scientific Name[a]	Common Name	Wetland Indicator Status[b]	Wetland A	Wetland B	West Flume
Acer negundo	Box elder	FAC	✓	✓	✓(E)
Fraxinus pennsylvanica	Green ash	FACW	✓(E)	✓(E)	✓(E)
Juglans nigra	Black walnut	FACU	✓		✓
Populus deltoides	Eastern cottonwood	FAC	✓(E)	✓(E)	✓(E)
Populus tremuloides	Quaking aspen	FACU	✓	✓	(E)
Quercus bicolor	Swamp white oak	FACW		✓	
Robinia pseudoacacia	Black locust	FACU	✓	✓(E)	
Salix amygdaloides	Peach-leaf willow	FACW	✓	✓(E)	✓(E)
Salix sp.	Willow	FACW		✓(E)	(E)

SHRUBS

Scientific Name[a]	Common Name	Wetland Indicator Status[b]	Wetland A	Wetland B	West Flume
Cornus alba	Red-osier dogwood	FACW		✓	✓
Cornus amomum	Silky dogwood	FACW	✓	✓	✓
Cornus racemosa	Grey dogwood	FAC			(E)
Lonicera morrowii	Morrow's honeysuckle	FACU	✓(E)	(E)	(E)
Rhamnus cathartica	Common buckthorn	FACU	(E)	✓(E)	✓(E)
Rhus hirta	Staghorn sumac	UPL		(E)	✓(E)
Salix discolor	Pussy willow	FACW		✓(E)	✓
Salix purpurea	Streamco willow	FACW	✓	✓	✓
Sambucus canadensis	Elderberry	FACW			✓

HERBACEOUS

Scientific Name[a]	Common Name	Wetland Indicator Status[b]	Wetland A	Wetland B	West Flume
Agrostis gigantea	Redtop	FACW	✓	✓	✓
Agrostis hyemalis	Ticklegrass	FAC		(E)	
Agrostis stolonifera	Creeping bentgrass	FACW			✓

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[a] Nomenclature follows Mitchell and Tucker (1997).

[b] Obligate Wetland (OBL): occur almost always (estimated probability >99%) in wetlands. Facultative Wetland (FACW): usually occur in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands. Facultative (FAC): equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%). Facultative Upland (FACU): usually occur in non-wetlands (estimated probability 67%-99%), but occasionally found in wetlands (estimated probability 1%-33%). Obligate Upland (UPL): occur almost always (estimated probability >99%) in non-wetlands.

(E) - Found primarily along the edge of the restoration area.

Table 4. (cont.)

HERBACEOUS (cont.)

Scientific Name[a]	Common Name	Wetland Indicator Status[b]	Wetland A	Wetland B	West Flume
Alisma subcordatum	Water plantain	OBL	✓		✓
Ambrosia artemisiifolia	Ragweed	FACU	(E)		(E)
Andropogon gerardii	Big bluestem	FACU	(E)		
Apocynum cannabinum	Indian hemp	FAC	✓(E)	✓(E)	(E)
Arctium minus	Common burdock	FACU	✓(E)	(E)	
Artemisia vulgaris	Felon-herb mugwort	FACU	✓(E)		
Asclepias syriaca	Common milkweed	FACU			✓(E)
Aster ericoides	White heath aster	FACU		(E)	
Aster sp.	Aster	FAC	✓	✓	✓
Atriplex patula	Seaside orach	FACW			✓
Bidens frondosa	Devil's Beggar-ticks	FACW			✓
Bidens trichosperma	Large-fruit beggar-ticks	OBL	✓		
Bromus inermis	Smooth brome	FACU	✓(E)	(E)	(E)
Carex comosa	Long-hair sedge	OBL	✓	✓	✓
Carex cristatella	Sedge	FACW			✓
Carex granularis	Meadow sedge	FACW	✓	✓	
Carex lurida	Shallow sedge	OBL	✓	✓	✓
Carex scoparia	Broom sedge	FACW	✓	✓	✓
Carex sp.	Crested sedge	FACW	✓		
Carex stipata	Awlfruit sedge	OBL	✓		
Carex vulpinoidea	Fox sedge	OBL	✓	✓	✓
Centaurea maculosa	Spotted knapweed	FACU	✓	✓	✓(E)
Ceratophyllum demersum	Coontail	OBL		✓	✓
Chara sp.	Moss	OBL	✓	✓	
Chenopodium album	Lamb's-quarters	FACU	(E)		
Chenopodium glaucum	Oak-leaf goosefoot	FACW	✓		
Cichorium intybus	Chicory	FACU	(E)	(E)	(E)
Cirsium arvense	Canada thistle	FACU	✓(E)	(E)	(E)
Cirsium vulgare	Bull thistle	FACU	(E)	(E)	
Conyza canadensis	Horseweed	FACU		(E)	
Coronilla varia	Crown-vetch	UPL		(E)	(E)
Cyperus esculentus	Yellow nutsedge	FACW	✓		(E)
Dactylis glomerata	Orchard grass	FACU	✓(E)	✓	(E)
Daucus carota	Wild carrot	FACU	✓(E)	✓(E)	(E)
Dipsacus fullonum	Teasel	FACU	✓(E)	✓	✓(E)
Echinochloa crusgalli	Barnyard grass	FACU	✓	✓	
Eleocharis sp.	Spikerush	FACW	✓		
Elodea nuttallii	Western water-weed	OBL		✓	
Elodea sp.	Water-weed	OBL		✓	
Elymus virginicus	Virginia wild rye	FACW	(E)	(E)	
Epilobium coloratum	Purple-leaf willow-herb	OBL	✓	✓(E)	✓

Table 4. (cont.)

HERBACEOUS (cont.)

Scientific Name[a]	Common Name	Wetland Indicator Status[b]	Wetland A	Wetland B	West Flume
Epilobium hirsutum	Hairy willow-herb	FACW	✓	✓	✓
Equisetum arvense	Common horsetail	FAC		(E)	(E)
Erechtites hieracifolia	Pilewort	FACU			✓
Erigeron annuus	Daisy fleabane	FACU	(E)	✓(E)	
Eupatorium maculatum	Spotted Joe-pye-weed	OBL			✓
Eupatorium perfoliatum	Boneset	FACW	✓	✓	✓
Euthamia graminifolia	Flat-top goldenrod	FAC	✓	(E)	
Fragaria virginiana	Strawberry	FACU		(E)	(E)
Galium palustre	Marsh bedstraw	OBL	✓	✓	✓
Galium sp.	Bedstraw	FAC	✓		
Geum aleppicum	Yellow avens	FAC	✓		
Geum laciniatum	Rough avens	FACW	✓	(E)	(E)
Geum macrophyllum	Large leaf avens	FACW		(E)	✓
Glechoma hederacea	Ground ivy	FACU	(E)		(E)
Glyceria striata	Fowl meadowgrass	OBL	✓		
Holcus lanatus	Velvet grass	FACU	✓	✓	
Hypericum punctatum	St. John's-wort	FAC	✓	(E)	✓(E)
Impatiens capensis	Jewelweed	FACW		✓	✓
Inula helenium	Elecampane	FACU		(E)	
Juncus brachycephalus	Small-headed rush	OBL	✓		✓
Juncus dudleyi	Dudley's rush	FACW	✓		
Juncus effusus	Soft rush	OBL	✓	✓	✓
Juncus inflexus	Blue rush	OBL	✓	✓	
Juncus sp.	Rush	FAC		✓	
Juncus tenuis	Path rush	FAC	✓	✓	
Lactuca sp.	Lettuce	FACU	✓	(E)	
Lathyrus sylvestris	Flat pea	FAC	✓(E)		(E)
Leersia oryzoides	Rice cutgrass	OBL	✓	✓	✓
Lemna minor	Lesser duckweed	OBL	✓	✓	
Lemna trisulca	Star duckweed	OBL		✓	
Lepidium sp.	Peppergrass	FACU	✓(E)	(E)	
Lotus corniculata	Bird's-foot trefoil	FACU	✓(E)	✓	(E)
Lythrum salicaria	Purple loosestrife	OBL	✓	✓	✓
Melilotus alba	White sweet clover	FACU		(E)	(E)
Melilotus officinalis	Yellow sweet clover	FACU	(E)	(E)	
Mimulus ringens	Winged monkeyflower	OBL		✓	
Muhlenbergia sp.	Muhly	FAC	✓		
Myriophyllum spicatum	Eurasian milfoil	OBL		✓	
Nymphaea odorata	White water-lily	OBL		✓	
Oenothera biennis	Evening primrose	FACU	✓	(E)	

Table 4. (cont.)

HERBACEOUS (cont.)

Scientific Name[a]	Common Name	Wetland Indicator Status[b]	Wetland A	Wetland B	West Flume
Onoclea sensibilis	Sensitive fern	FACW			(E)
Panicum sp.	Panic grass	FAC	(E)		
Panicum virgatum	Panic grass	FACW		✓(E)	
Parthenocissus quinquefolia	Virginia creeper	FACU	✓		
Penstemon digitalis	False-foxglove	FAC	✓	✓	✓
Persicaria hydropiperoides	Marsh water pepper	OBL			✓
Persicaria maculosa	Lady's-thumb	FAC	✓		✓
Persicaria pensylvanica	Pennsylvania smartweed	FACW	✓		
Phalaris arundinacea	Reed canary grass	FACW	✓	✓	✓
Phleum pratense	Timothy	FACU	✓(E)		(E)
Phragmites australis	Common reed	FACW	✓		✓
Picris hieracoides	Ox-tongue	FACU	✓(E)	✓(E)	(E)
Plantago lanceolata	Narrow-leaf plantain	FACU	✓(E)	✓(E)	(E)
Plantago major	Common plantain	FACU	✓(E)	✓(E)	(E)
Poa compressa	Canada bluegrass	FACU	✓	✓	
Poa pratensis	Kentucky bluegrass	FACU			✓
Potamogeton crispus	Curly pondweed	OBL		✓	
Potentilla recta	Sulfer cinquefoil	UPL		✓	
Prunella vulgaris	Heal-all	FAC		(E)	
Ranunculus sp.	Buttercup	FAC	✓		
Rorippa nasturtium-aquaticum	Watercress	OBL		✓	
Rubus occidentalis	Black raspberry	UPL			(E)
Rumex sp.	Dock	FAC	✓(E)		✓
Schoenoplectus tabernaemontani	Soft-stem bulrush	OBL	✓	✓	✓
Scirpus atrovirens	Green bulrush	OBL	✓	✓	✓
Scirpus cyperinus	Woolgrass	OBL	✓		
Scirpus pedicellatus	Stalked bulrush	OBL	✓	✓	
Setaria faberi	Giant foxtail	FACU	(E)		
Solanum carolinense	Horse nettle	UPL			✓
Solanum dulcamara	Bittersweet nightshade	FAC			✓
Solidago canadensis	Canada goldenrod	FACU	✓(E)	(E)	(E)
Solidago rugosa	Rough goldenrod	FAC	✓		
Sonchus asper	Spiny sow-thistle	FACU	✓(E)		
Sonchus oleraceus	Sow-thistle	FACU	✓(E)		
Sparganim americanum	American burreed	OBL	✓	✓	
Stuckenia pectinata	Sago pondweed	OBL	✓	✓	
Symphyotrichum lanceolatum	Lance-leaved aster	FACW		(E)	
Symphyotrichum pilosum	White heath aster	FACU	(E)	(E)	(E)
Symphyotrichum puniceum	Purple-stemmed aster	OBL		(E)	

Table 4. (cont.)

HERBACEOUS (cont.)

Scientific Name[(a)]	**Common Name**	**Wetland Indicator Status**[(b)]	**Wetland A**	**Wetland B**	**West Flume**
Taraxacum officinale	Dandelion	FACU		(E)	
Trifolium hybridum	Alsike clover	FACU	✓(E)	✓(E)	
Trifolium pratense	Red clover	FACU			(E)
Tussilago farfara	Colt's foot	FACU	✓(E)	✓	
Typha angustifolia	Narrow-leaf	OBL	✓	✓	✓
Typha latifolia	Broad-leaf cattail	OBL	✓	✓	✓
Typha x glauca	White cattail	OBL	✓	✓	✓
Utricularia macrorhiza	Common bladder-wort	OBL		✓	
Verbascum blattaria	Moth-mullein	FACU		✓	✓(E)
Verbena hastata	Blue vervain	FACW	✓	✓	
Verbena urticifolia	White vervain	FAC		✓	
Vicia sp.	Vetch	FAC	✓(E)	✓(E)	(E)
Vitis riparia	Riverbank grape	FAC		(E)	(E)
Xanthium strumarium	Common cocklebur	FAC		✓	

Table 5.

Vegetation Data Summary, Wetland A, Emergent Cover Type
LCP Bridge Street Restoration Area (2012)

Scientific Name[a]	**Common Name**	**Indicator Status[b]**	**Relative Cover (%)**
Typha latifolia	Broad-leaf cattail	OBL	63.43
Phragmites australis	Common reed	FACW	24.25
Typha x glauca	White cattail	OBL	7.47
Schoenoplectus tabernaemontani	Soft-stem bulrush	OBL	3.73
Lythrum salicaria	Purple loosestrife	OBL	0.75
Lemna minor	Lesser Duckweed	OBL	0.37
		Total	100.00

[a] Nomenclature follows Mitchell and Tucker (1997).

[b] Obligate Wetland (OBL): occur almost always (estimated probability >99%) in wetlands. Facultative Wetland (FACW): usually occur in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands. Facultative (FAC): equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%). Facultative Upland (FACU): usually occur in non-wetlands (estimated probability 67%-99%), but occasionally found in wetlands (estimated probability 1%-33%). Obligate Upland (UPL): occur almost always (estimated probability >99%) in non-wetlands.

Table 6

Vegetation Data Summary, Wetland B, Emergent Cover Type
LCP Bridge Street Restoration Area (2012)

Scientific Name[a]	Common Name	Indicator Status[b]	Relative Cover (%)
Typha x glauca	White cattail	OBL	32.12
Typha latifolia	Broad-leaf cattail	OBL	23.03
Typha angustifolia	Narrow-leaf cattail	OBL	12.73
Phragmites australis	Common reed	FACW	7.27
Schoenoplectus tabernaemontani	Soft-stem bulrush	OBL	5.46
Leersia oryzoides	Rice cutgrass	OBL	4.85
Lythrum salicaria	Purple loosestrife	OBL	4.49
Lemna trisulca	Star duckweed	OBL	3.64
Nymphaea odorata	White water lily	OBL	2.42
Ceratophyllum demersum	Coontail	OBL	2.42
Persicaria hydropiperoides	Mild water pepper	OBL	0.61
Lemna minor	Duckweed	OBL	0.24
Fraxinus pennsylvanica	Green ash	FACW	0.24
Eupatorium perfoliatum	Boneset	FACW	0.12
Cyperus esculentus	Yellow nutsedge	FACW	0.12
Carex sp.	Sedge	FAC	0.12
Populus tremuloides	Quaking aspen	FACU	0.12
		Total	100.00

[a] Nomenclature follows Mitchell and Tucker (1997).

[b] Obligate Wetland (OBL): occur almost always (estimated probability >99%) in wetlands. Facultative Wetland (FACW): usually occur in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands. Facultative (FAC): equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%). Facultative Upland (FACU): usually occur in non-wetlands (estimated probability 67%-99%), but occasionally found in wetlands (estimated probability 1%-33%). Obligate Upland (UPL): occur almost always (estimated probability >99%) in non-wetlands.

Table 7.

Vegetation Data Summary, Wetland B, Aquatic Bed Cover Type
LCP Bridge Street Restoration Area (2012)

Scientific Name[a]	Common Name	Indicator Status[b]	Relative Cover (%)
Ceratophyllum demersum	Coontail	OBL	39.09
Nymphaea odorata	White water lily	OBL	20.80
Lemna trisulca	Star duckweed	OBL	15.49
Utricularia macrorhiza	Common Bladderwort	OBL	9.88
Typha latifolia	Broad-leaf cattail	OBL	7.37
Elodea nuttallii	Western water-weed	OBL	2.95
Typha glauca	White cattail	OBL	2.21
Lemna minor	Duckweed	OBL	1.47
Chara sp.	Moss	OBL	0.74
		Total	100.00

[a] Nomenclature follows Mitchell and Tucker (1997).

[b] Obligate Wetland (OBL): occur almost always (estimated probability >99%) in wetlands. Facultative Wetland (FACW): usually occur in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands. Facultative (FAC): equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%). Facultative Upland (FACU): usually occur in non-wetlands (estimated probability 67%-99%), but occasionally found in wetlands (estimated probability 1%-33%). Obligate Upland (UPL): occur almost always (estimated probability >99%) in non-wetlands.

Table 8.

Vegetation Data Summary, West Flume, Emergent Cover Type
LCP Bridge Street Restoration Area (2012)

Scientific Name[a]	Common Name	Indicator Status[b]	Relative Cover (%)
Phragmites australis	Common reed	FACW	55.84
Typha glauca	White cattail	OBL	15.58
Typha latifolia	Broad-leaf cattail	OBL	11.17
Lythrum salicaria	Purple loosestrife	OBL	6.49
Sonchus asper	Spiny leaved sow thistle	FACU	5.20
Leeesia oryzoides	Rice Cutgrass	OBL	3.90
Cirsium arvense	Canada thistle	FACU	0.52
Epilobium hirsutum	Hairy willow-herb	FACW	0.52
Solanum dulcamara	Bittersweet nightshade	FAC	0.52
Persicaria hydropiperoides	Mild water pepper	OBL	0.26
		Total	100.00

[a] Nomenclature follows Mitchell and Tucker (1997).

[b] Obligate Wetland (OBL): occur almost always (estimated probability >99%) in wetlands. Facultative Wetland (FACW): usually occur in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands. Facultative (FAC): equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%). Facultative Upland (FACU): usually occur in non-wetlands (estimated probability 67%-99%), but occasionally found in wetlands (estimated probability 1%-33%). Obligate Upland (UPL): occur almost always (estimated probability >99%) in non-wetlands.

Table 9.

Staff Gauge Readings, 2012
LCP Bridge Street Restoration Area

Wetland A

Date	Reading on Gauge (feet)	0.0 Elevation (feet)	Water Elevation (feet)
6/8/12	1.26	378.84	380.10
6/14/12	1.22	378.84	380.06
6/28/12	0.88	378.84	379.72
7/31/12	0.58	378.84	379.42
8/14/12	-	378.84	<378.84
8/28/12	0.60	378.84	379.34
9/12/12	-	378.84	<378.84
9/17/12	-	378.84	<378.84
10/11/12	1.41	378.84	380.25

Wetland B

Date	Reading on Gauge (feet)	0.0 Elevation (feet)	Water Elevation (feet)
6/8/12	1.86	374.16	376.02
6/14/12	1.80	374.16	375.96
6/28/12	1.48	374.16	375.64
7/19/12	1.06	374.16	375.22
7/31/12	0.98	374.16	375.14
8/14/12	0.82	374.16	374.98
8/28/12	0.72	374.16	374.88
9/12/12	0.52	374.16	374.68
9/17/12	0.52	374.16	374.68
10/11/12	0.83	374.16	374.99

- Dry conditions

Table 10.

Wildlife Observed, 2012, LCP Bridge Street Restoration Area

BIRDS[a]				
Common Name	**Scientific Name**	**LCP Bridge Street Restoration Area**		
		Wetland A	**Wetland B**	**West Flume**
Canada Goose	*Chen caerulescens*		X	X
Wood Duck	*Aix sponsa*		X	
American Black Duck	*Anas rubripes*		X	
Mallard	*Anas platyrhynchos*	X	X	X
Pied-billed Grebe	*Podilymbus podiceps*		X	
Double-crested Cormorant	*Phalacrocorax auritus*		X	
Great Blue Heron	*Ardea herodias*			X
Green Heron	*Butorides virescens*	X	X	X
Turkey vulture	*Cathartes aura*		f.o. [b]	
Sharp-shinned Hawk	*Accipiter striatus*			f.o.
Red-tailed Hawk	*Buteo jamaicensis*	f.o.		f.o.
American Coot	*Fulica americana*		X	
Killdeer	*Charadrius vociferus*		X	
Rock Pigeon	*Columba livia*		f.o.	
Mourning Dove	*Zenaida macroura*	X		X
Chimney Swift	*Chaetura pelagica*		f.o.	
Belted Kingfisher	*Megaceryle alcyon*		X	
Willow Flycatcher	*Empidonax traillii*		X	
Warbling Vireo	*Vireo gilvus*		X	
Blue Jay	*Cyanocitta cristata*			X
Tree Swallow	*Tachycineta bicolor*	X	X	
Barn Swallow	*Hirundo rustica*		X	
Gray Catbird	*Dumetella carolinensis*	X	X	X
Northern Mockingbird	*Mimus polyglottos*			X
Cedar Waxwing	*Bombycilla cedrorum*	X		
Yellow warbler	*Dendroica petechiax*	X	X	
Song Sparrow	*Melospiza melodia*		X	X
Swamp Sparrow	*Melospiza georgiana*	X	X	X
Northern Cardinal	*Cardinalis cardinalis*			X
Red-winged Blackbird	*Agelaius phoeniceus*	X	X	X
Common Grackle	*Quiscalus quiscula*		X	
American Goldfinch	*Carduelis tristis*	X		X

a. Common and scientific names according to AOU (1998) and supplements through 2008.
b. f.o. = fly over.

Table 10. (cont.)

AMPHIBIANS AND REPTILES[c]				
Common Name	**Scientific Name**	**LCP Bridge Street Restoration Area**		
		Wetland A	**Wetland B**	**West Flume**
Eastern American Toad	*Anaxyrus americanus*	X		
American Bullfrog	*Lithobates catesbeianus*		X	
Northern Green Frog	*Lithobates clamitans melanota*	X	X	X
Northern Leopard Frog	*Lithobates pipiens*	X	X	X
Eastern Snapping Turtle	*Chelydra s. serpentine*		X	
Painted Turtle	*Chrysemys picta*		X	
Common Watersnake	*Nerodia s. sipedon*		X	
Common Gartersnake	*Thamnophis sirtalis*	X	X	X

MAMMALS[d]				
Common Name	**Scientific Name**	**LCP Bridge Street Restoration Area**		
		Wetland A	**Wetland B**	**West Flume**
Short-tailed Shrew[e]	*Blarina brevicauda*			
White-footed Mouse[e]	*Peromyscus leucopus*			
Meadow Vole[e]	*Microtus pennsylvanicus*			
American Beaver	*Castor canadensis*		X	
Common Muskrat	*Ondatra zibethicus*	X	X	X
White-tailed Deer	*Odocoileus virginianus*	X		

c. Common and scientific names according to Crother *et al.* (2008).
d. Common and scientific names according to Whitaker and Hamilton (1998).
e. Collected during Bioassessment

Table 11.

Mammals, Fish, Amphibians, and Macroinvertebrates Collected during 2012 Bioassessment Surveys, LCP Bridge Street Restoration Area

MAMMALS

Common Name	**Scientific Name**
Short-tailed Shrew	*Blarina brevicauda*
White-footed Mouse	*Peromyscus leucopus*
Meadow Vole	*Microtus pennsylvanicus*

FISH

Common Name	**Scientific Name**
Creek Chub	*Semotilus atromaculatus*
Brook Stickleback	*Culaea inconstans*

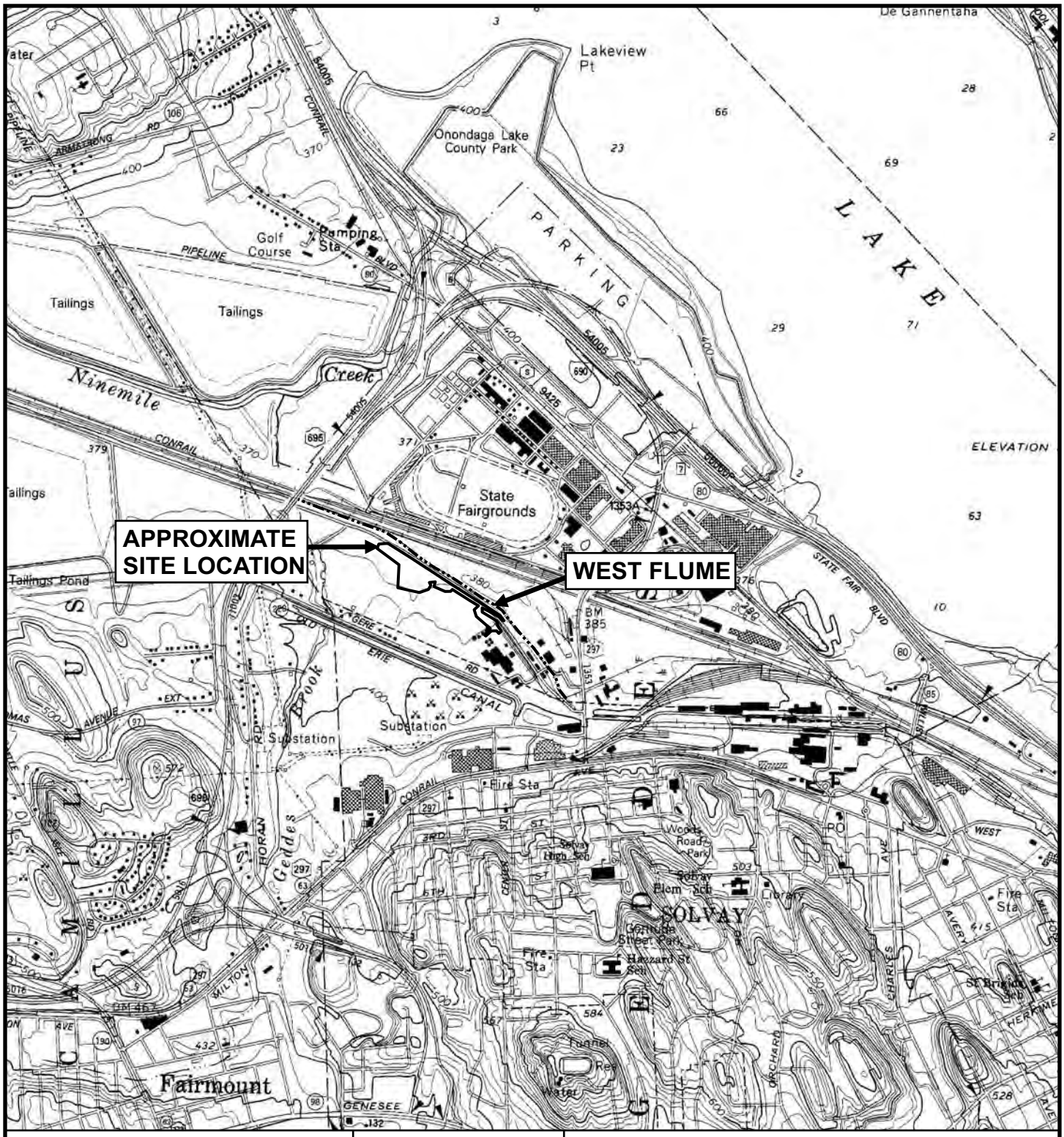
AMPHIBIANS

Common Name	**Scientific Name**
Northern Green Frog (tadpole)	*Lithobates clamitans melanota*

MACROINVERTEBRATES

Common Name	**Invertebrate Order**
Crayfish	Decopoda
Dragonflies and Damselflies	Odonata
Earthworms	Haplotaxida

FIGURES



0 1000' 2000'

SCALE 1" = 2000'

NORTH

Figure 1. Site Location

LCP Bridge Street Restoration Area

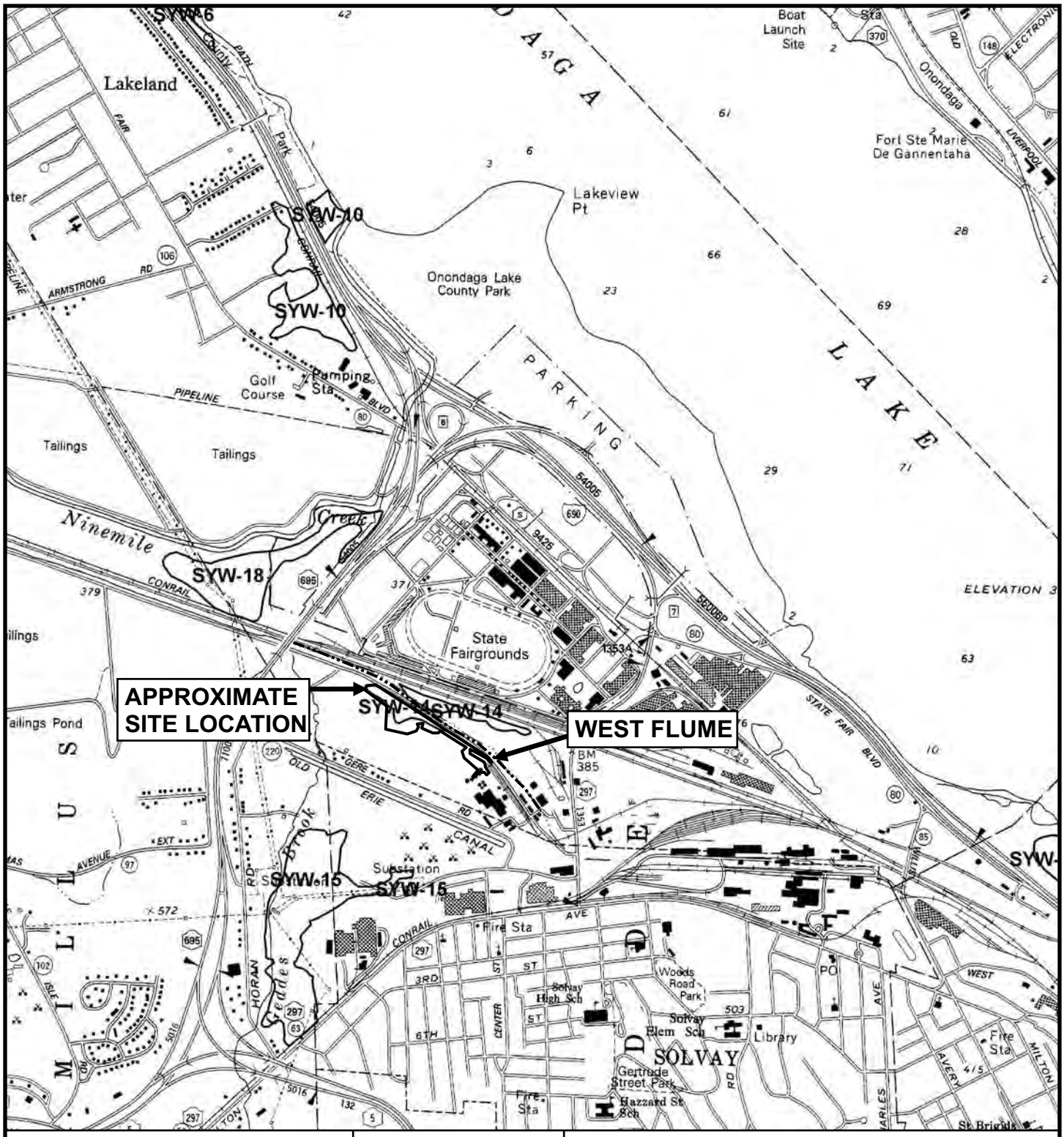
NYS DOT Topographic Map

Syracuse West Quadrangle

1990

Prepared by TERRESTRIAL ENVIRONMENTAL SPECIALISTS, Inc.

TES file: PAR-2682\2682_Monit_Rpt_2011_site_location_1.dsf\10-21-11



0 1000' 2000'

SCALE 1" = 2000'

NORTH

Figure 2. NYS Freshwater Wetlands Map

LCP Bridge Street Restoration Area

NYS Dept. of Environmental Conservation
cugir.mannlib.cornell.edu

Syracuse West Quadrangle
2007

Prepared by TERRESTRIAL ENVIRONMENTAL SPECIALISTS, Inc.

TES file: PAR-2682\2682_Monit_Rpt_2011_DEC_wetlands_2.dsf\10-21-11